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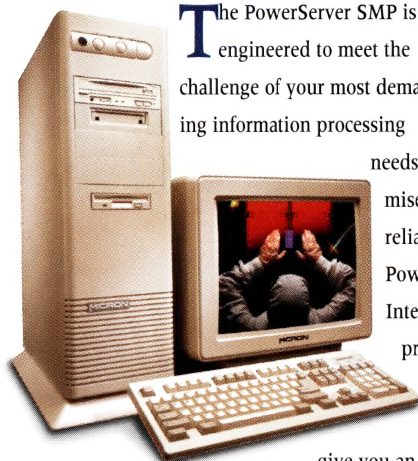
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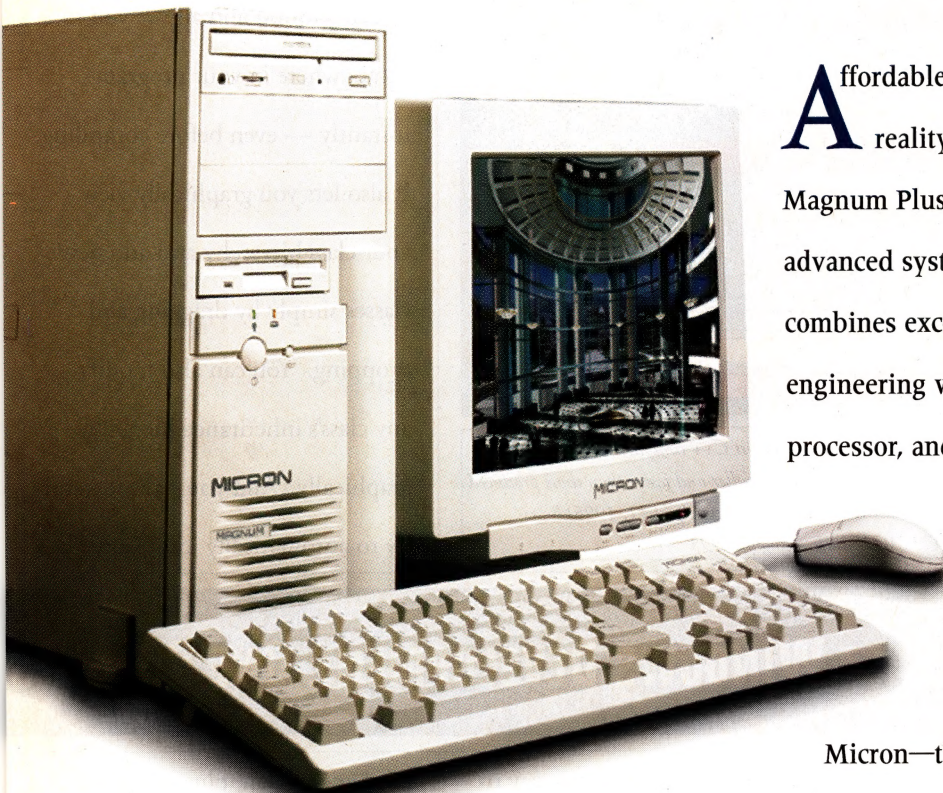
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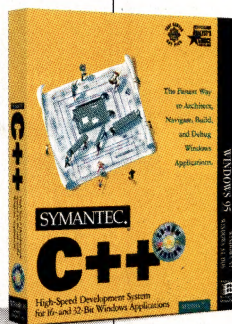
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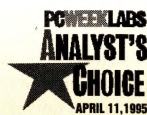
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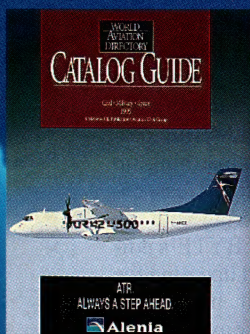
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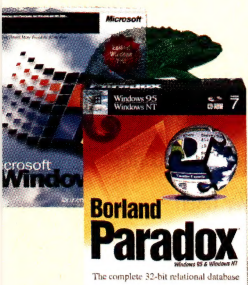
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developers continue to improve on the Web's built-in hyper-linking capabilities. The SlipKnot 1.13 browser from MicroMind (slipknot@micromind.com) for Windows and OS/2 downloads data from all local HTML links (i.e., links specific to a given Web site) to your system in the background. This allows you to get a broad view of a Web site either on- or offline. Spyglass and NCSA are adding a similar feature to their browsers, but SlipKnot lets users pick and choose what links they want downloaded.

As browsers encroach on the turf of traditional applications such as word processors, as well as that of tools for developing custom front ends, companies like Microsoft are adapting. For example, Microsoft is investigating ways in which Visual Basic can act as a front-end development tool for the company's Internet Explorer 2.0. The company is also developing an electronic publishing tool (known as Blackbird) for the Microsoft Network and the Web.

Internet connectivity is important, agrees Chris Flores, Microsoft's product manager for Visual Basic. But he also says the Internet is just another extension for Visual Basic, which is a popular tool today among corporate developers for creating custom front ends. More than 1000 custom controls are available for Visual Basic developers today, Flores says, and several companies are developing controls for Internet access. However, Visual Basic is not a strong cross-platform solution thanks to Microsoft's Windows-centric strategy: There's no Visual Basic for the Mac, and few, if any, OLE Controls that will run natively on the Macintosh.

Netscape faces formidable competition but is ahead of Microsoft and other developers in building the ultimate TCP/IP network tool interface, says New Media's Allaire. Furthermore, Netscape is doing so at the application level for three major end-user operating systems: DOS/Windows, MacOS, and Unix.

PROCESSORS

Intel Beats the Clock ... Again

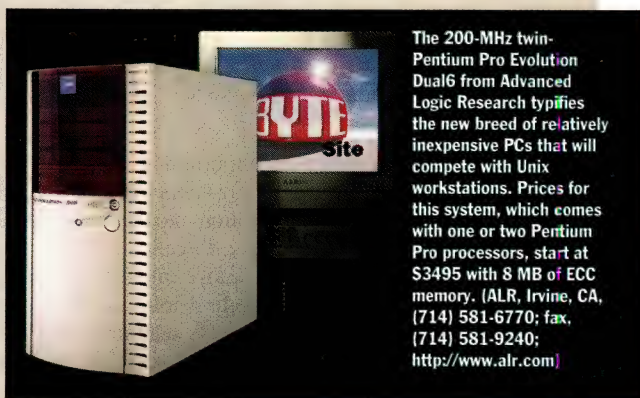
Intel's surprise rollout of its 200-MHz Pentium Pro (aka the P6) processor will force its competitors in both the RISC and CISC camps to play catch-up this year. Most industry insiders expected Intel to release a 150-MHz, 256-KB-cache version of the Pentium Pro for desktop PCs and workstations in 1995, then follow with a 166-MHz, 512-KB-cache version for servers in the first quarter of 1996.

Instead, Intel is releasing those chips as scheduled, plus 180-MHz and 200-MHz versions during this quarter. (Both will have 256-KB cache and, like the 166-MHz Pentium Pro, will be built on Intel's .35-micron manufacturing process.) Intel will also release a 200-MHz, 512-KB-cache Pentium Pro in the second quarter of this year.

Intel experienced better-than-expected yields with its .35-micron process, which helped accelerate the release of the 200-MHz processor, company officials said. Several PC manufacturers told BYTE that the early availability of the 200-MHz version was a pleasant surprise. Intel's competitors were probably not as pleased: BYTE's cross-platform CPU benchmarks indicate that the 200-MHz Pentium Pro delivers 2.8 times the integer performance of a 90-MHz Pentium, and about 3.5 times the floating-point performance.

The 200-MHz Pentium Pro will show up in the kinds of workstations typically powered by RISC CPUs. Peter Lowber, senior analyst for workstations and servers at Datapro (Lexington, MA), says the 200-MHz Pentium Pro undermines the RISC value proposition. Although Digital, SGI, and HP will likely surpass Pentium Pro performance when they release new chips this year, Lowber says the RISC vendors must demonstrate substantially superior performance over relatively inexpensive Intel solutions.

The news is worse for Intel's x86 competitors, AMD and Cyrix. AMD, which recently acquired NexGen, and Cyrix both sell Pentium-class processors now and won't ship Pentium Pro competitors for running 32-bit software before the end of this year. Meanwhile, Intel's Pentium prices have plummeted. A 200-



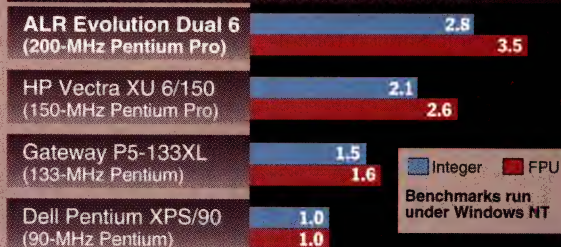
The 200-MHz twin-Pentium Pro Evolution Dual6 from Advanced Logic Research typifies the new breed of relatively inexpensive PCs that will compete with Unix workstations. Prices for this system, which comes with one or two Pentium Pro processors, start at \$3495 with 8 MB of ECC memory. (ALR, Irvine, CA, (714) 581-6770; fax, (714) 581-9240; <http://www.alr.com>)

MHz, 256-KB-cache Pentium Pro sells for \$1325 (in quantities of 1000); a 75-MHz Pentium costs just \$158 (the 60-MHz Pentium originally sold for \$878). "I think Cyrix and AMD will have problems," Lowber says. "They're playing catch-up again."

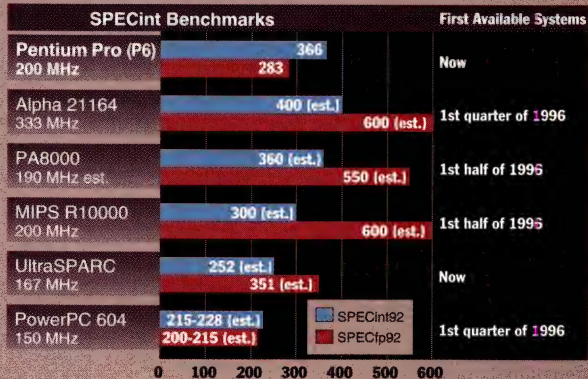
—Dave Andrews

Looking Good at 200

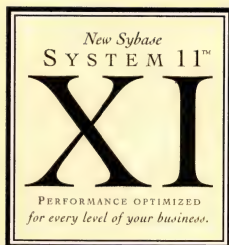
BYTEMARK 32-bit CPU/FPU Benchmarks



P6 Competition Heats Up in 1996



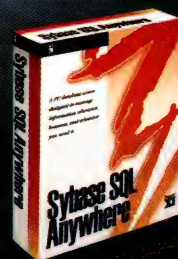
Intel's RISC competitors will release new processors this year that should pass the Pentium Pro in performance. Also, while Pentium Pro processors are currently being built on a .35-micron manufacturing process, Intel's competitors are expected to release even higher-performing .3x-micron chips (not included in this chart) late this year.



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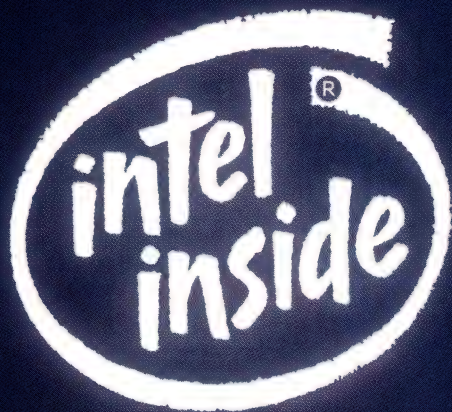
A large background image of an astronaut floating in space, looking out at a bright sun and a rainbow. The astronaut is wearing a full space suit and is positioned on the left side of the frame, reaching out towards the right. The sun is a bright, glowing orb in the upper right, and a rainbow is visible in the lower right. The overall scene is a dramatic, high-contrast image of space exploration.

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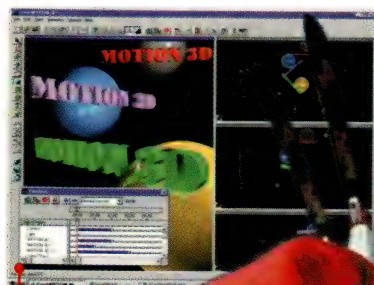
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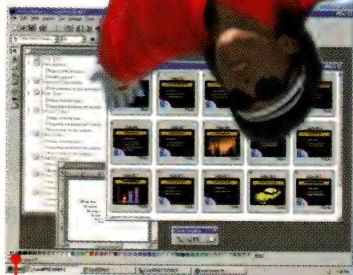
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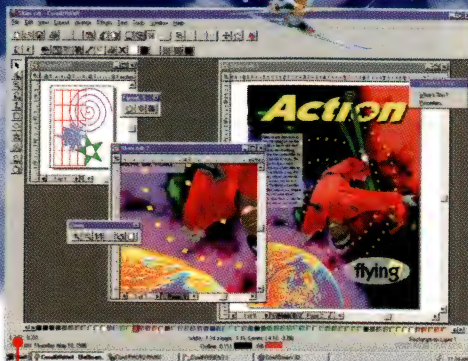
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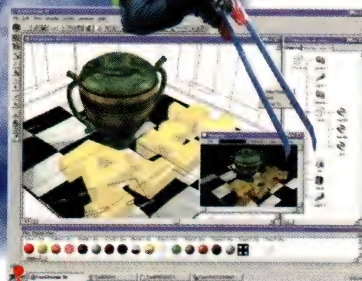
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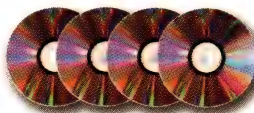


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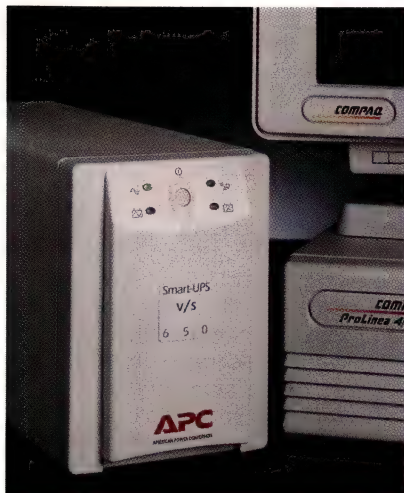
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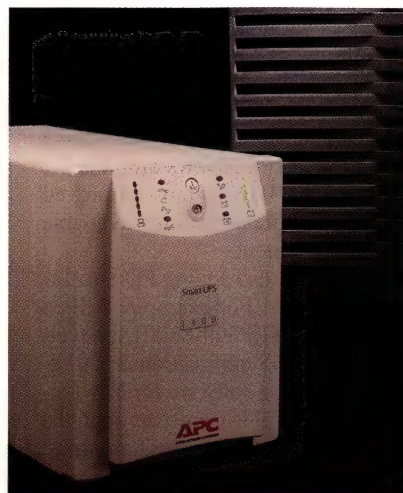
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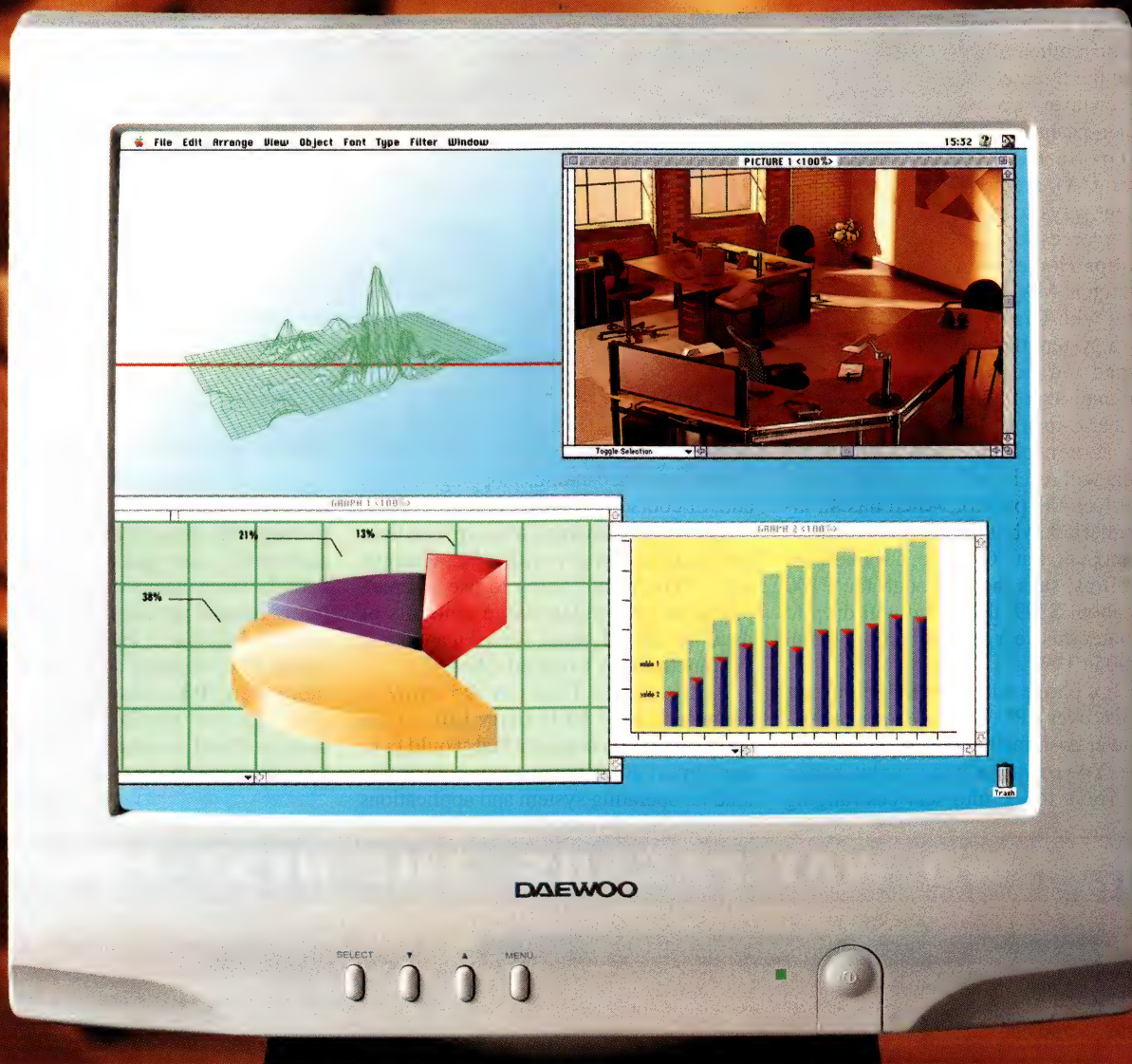
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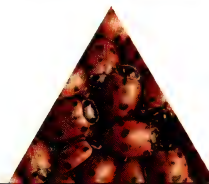


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Smart Telephony

Gadgets like the Philips screen phone and technologies like ADSI will change the way you access information.
page 40IS 13

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New software can help managers make better decisions.

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Interactive Highway

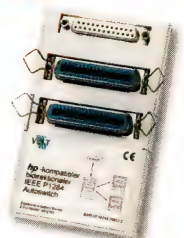
TV and telephone technology will drive the Infobahn.

page 40IS 17

25212 Printer Switch

This traffic cop can help prevent jam-ups in the printing queue.

page 40IS 24



NEWS & VIEWS

Open Telecommunications Standards

Telcos need to integrate new products into tomorrow's intelligent networks

A tidal wave of change is hitting the telecommunications industry: Open and modular computing technology is replacing the monolithic kernels of today's telecommunications equipment. This process is driven not only by telecommunications companies' need to develop products that integrate with the intelligent networks of tomorrow's information highway but also by increased time-to-market pressures. "Telecommunications is becoming so competitive that we can't afford to go on with our proprietary systems," says Gerhard Ott, head of marketing and systems architecture at Siemens Private Communications Systems (Munich, Germany).

Traditionally, telecommunications equipment vendors, such as Alcatel, Philips, and Siemens, built their PBXes and switches using homegrown OSes. "As our devices get more and more sophisticated, we need open, real-time OSes that are scalable and at the same time very fault tolerant," says Hans Heilborn of Ericsson in Stockholm, Sweden.

In an effort to standardize an industrywide distributed processing environment (DPE), a group of European Telecom service providers and equipment vendors has founded the Real-Time Telecommunications Information Networking Architecture (ReTINA) consortium, which will specify interaction models for multimedia traffic. It will use the ISO/ITU Open Distributed

Processing (ODP) reference model as a framework, and its models will be compliant with the Common Object Request Broker Architecture (CORBA).

One possible platform for ReTINA is Chorus Systems' (Saint-Quentin-en-Yveline, France) microkernel technology (see "The Chorus Microkernel," January 1994 BYTE). This family of scalable, object-oriented OSes will serve as a common platform for fault-tolerant servers, PBXes, and switches, including set-top boxes and portable phones. The Chorus Nucleus/r6, the new base of Chorus Systems' real-time OS, has been developed within the STREAM research project of the European Community. However, this object-oriented technology will soon make its way into commercial products.

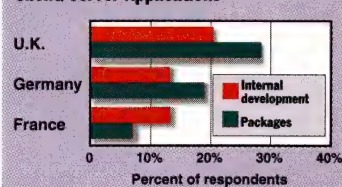
The Santa Cruz Operation has announced that it will integrate the microkernel into its OpenSever release 5 Unix OS and target it at the telecommunications market. The first major customer of the new SCO OS, code-named MK2 and scheduled to ship in early 1997, will be Siemens Private Communications Systems.

—Rainer Mauth

Client/Server: Europe Trails U.S.

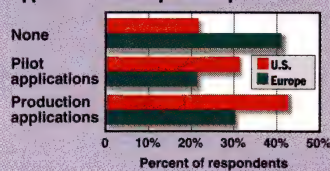
The market research firm Strategic Focus (Milpitas, CA) says that client/server implementations are lower in Europe than in the U.S. The firm's study reveals that 52 percent of the sites in Europe have experience in developing client/server ap-

Client/Server Applications



plications, compared to 74 percent in the U.S. The study also found that the percentage of sites in the U.K. and Germany

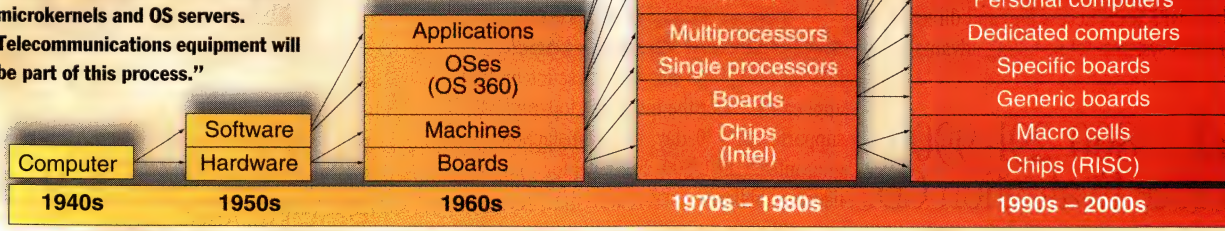
Applications Development Experience



implementing third-party client/server applications packages is higher than the percentage engaged in internal development and implementation. In France, meanwhile, the opposite situation is true.

As Complexity Increases...

According to Michel Gien, Chorus Systems' chief technology officer, "as the complexity in computer systems increases, you can see an ongoing separation of layers, like the division of biological cells. At the end of this decade, a standard OS, for example, will consist of special-purpose plug-in microkernels and OS servers. Telecommunications equipment will be part of this process."



A Consultant in Your PC

RAINER MAUTH

As European companies face more competition from American and Asian firms, programs that assist European executives in making better business decisions and planning complex operations are increasingly popular. Many of these programs engage the user in a Socratic dialogue by asking questions that force him or her to confront difficult issues and consider all the possible ramifications and alternatives. Collectively called MBAAware, these programs offer expert guidance in regard to general management issues, such as preparation for business negotiations, employee management, strategic analysis, and market forecasting.

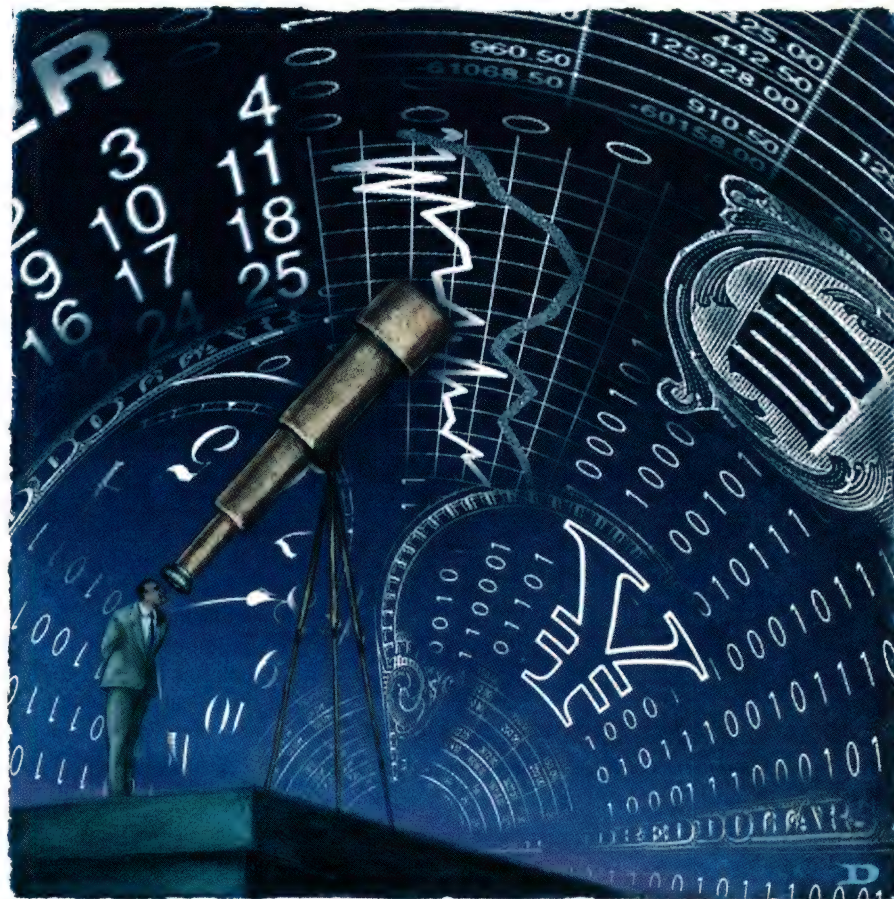
For example, ColumbusEIS, created by Jitcons (Ylivieska, Finland), manages return on capital, cash flow, and bottom-line profitability. It's based on three visual business models and is designed to offer jargon-free financial planning for managers of small- and medium-size enterprises.

ColumbusEIS breaks down a business's broad, overall goals into measurable financial targets, as well as into more specific intermediate goals, which it then shows in what's called a *Dupont Pyramid*. Meanwhile, a *Money Flow Pyramid* monitors a business's day-to-day operations, and at the end of the year it calculates the profitability in a *Capital Pyramid* showing assets and liabilities.

Once you enter your business's financial data (e.g., profit/loss statements) into ColumbusEIS, it presents the numbers in each pyramid graphically. It also presents a possible route for you to take toward your business goals and compares the goals with your actual financial base. ColumbusEIS is available in eight European-language versions, including adaptations to local financial cultures. The visual models are the same for all versions.

Ferreting Out Strengths and Weaknesses

Another MBAAware program, B-Plan's Business Planner 2.0, helps a business raise capital or generate financial statements.



BOB DAHM © 1996

As business becomes more competitive and global, new programs are helping managers make better plans and decisions

In addition, it builds complete business plans. It considers not only financial planning but also product development and a company's operational infrastructure. It collects business information, such as the five-year performance history, business goals (e.g., sales targets, growth rate, profitability, and market share), market analysis (e.g., com-

petition, segmentation, and market size), and the company's general strengths and weaknesses.

"Business planning is like a puzzle. To get the real picture of a business, it's necessary to collect all the bits and pieces and arrange them in the right way," says B-Plan's David Solomon. "Business Planner guides you step by step and allows you to think about each step."

The program's what-if engine provides a detailed analysis of how, for example, single items influence the success or failure of the entire business. B-Plan says that the next release of the German version of Business Planner will also support English in

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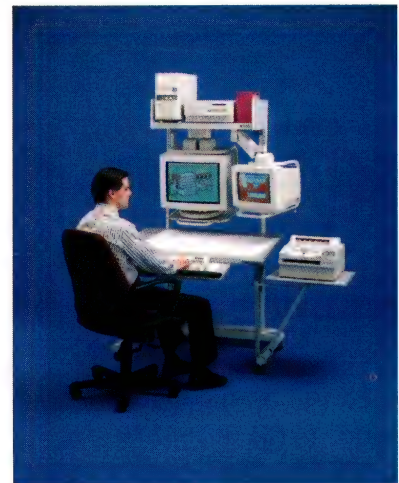
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Business School. Some examples are movements in market share, production control, and the influence of a single project on overall cash flow.

One tool that analyzes such system dynamics is Powersim from Powersim AS (Bergen, Norway). The program is based on a formal method that was developed in the late 1950s by Jay W. Forrester of the Sloan School of Management at MIT (Cambridge, MA). A Powersim model consists of a set of interrelated graphical variables, which you can connect using a diagram editor. You then use the Powersim simulation language to develop the exact definition of the relationship you're analyzing.

However, it takes several hours to produce your first useful model. "The development of a business model is usually a three-stage process," explains Eric Melse of Oasis Process Consulting (Nieuwegein, The Netherlands). "First of all, it's important that [members of] a team of managers share the same view of the world."

Powersim supports the first modeling stage, which is known as rough modeling, through *Causal-Loop Diagrams*, which offer heuristic models in which you do not have to distinguish between the different types of variables and connections. A Causal-Loop Diagram is then transformed into a flow diagram, using the graphical simulation language. This second stage is where the actual analysis of a process takes place and proposals for improvement show up. Finally, in the third modeling stage, you run several scenarios with different settings.

Creative Problem-Solving

Modern management approaches rely on not only analytical models but also the creative power of workgroups, especially

for carrying out innovative work. Whether you're designing new products, developing inventive marketing campaigns, or defining an outstanding user interface for a piece of software, creative problem-solving is important.

"Creativity always includes motivational and emotional aspects. But that's not an argument against computer support," explains Dr. Tapani Savolainen, director of CAC-Research (Espoo, Finland) and sometimes referred to as the father of computer-aided creativity (CAC). The result of his research is the second-generation

tool Idegen++, which supports problem-solving through brainstorming, idea generation, and idea-evaluation modules.

Idegen++ assists users in organizing and constructively evaluating ideas. "It's the opposite approach to artificial intelligence," explains Savolainen, "because it's the best computer in the world that solves the problem—the human brain." ■

Rainer Mauth is a senior editor in BYTE's Frankfurt bureau. You can contact him on the Internet or BIX at rmauth@bix.com or 75372.3464@compuserve.com.

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Smart Telephony

BOB EMMERSON

What exactly is this thing? It looks like someone crossed a telephone with a little TV screen. Look closer and you'll find a slide-out alphanumeric keyboard, plus slots for memory and smart cards. There's also a built-in modem, a printer output, and a serial interface for a bar-code or magnetic-stripe reader. Is it a feature phone, a data terminal, or a dual-media device?

None of the above. It's a smart "screen phone" from Philips. This souped-up device lets you have voice and data simultaneously over regular telephone wiring. This little gadget also represents a different approach to telephony than what most of the computer industry has been pushing.

With its P100 screen phones, Philips is taking the voice-centric route to computer telephony. "In our perspective, the road map to smart telephony is service," says Bill Hewlett, chief operations officer of Philips Home Service. The types of communication capabilities you can have with screen phones are call forwarding, call-waiting indication, and three-way calling, provided by the network operators; delivery of information, such as train and plane schedules, provided by third parties; and transaction-based services like home banking and ticket purchasing.

The Philips phone comes with an Intel 8086 processor. You can add up to 4 MB of memory by plugging in PC Cards (Flash or SRAM). Context-driven softkeys can be tied to small applications and make the phone easy to use.

International Protocol

The P100 is based on the Analog Display Services Interface (ADSI). This horizontal protocol—introduced by Bellcore in 1992—is being adopted by telecom operators in Scandinavia, the Netherlands, Spain, Italy, and the U.K., as well as by service providers. ADSI is basically a signaling protocol for use with existing voice networks. It enables analog transmission of voice and data. ADSI is universal in that if an information provider in, say, Madrid bases its service on ADSI, then anyone in the world with a Philips smart phone can use that service.

With ADSI, some services that have required digital connec-

With simultaneous voice and data, new screen phones will bring better services

tions can now come down ordinary analog lines. ADSI facilitates providing the kind of enhanced telephony services that many users require, particularly people who work in small businesses.

Having voice and data at your disposal means that interactive voice response (IVR) can be combined with downloadable

scripts. Thus, verbal instructions like "press 1 for sales, 2 for service" are replaced by menu options, so users don't have to remember which number to enter.

ADSI data is supplied in very short bursts. By muting the voice circuit during these intervals, caller ID and call-waiting information can be displayed—even when the user is talking. These features provide a new platform that allows IVR vendors and audiotex service providers to offer enhanced interactive services using voice and text.

In Europe ADSI will be implemented in different flavors and on different time scales. Caller ID, for example, may not work across certain national frontiers. However, ADSI is not dependent on the network. Information and services in the private sector function on an end-to-end basis. Thus, with ADSI implemented on a host server, people can access services from any ADSI-enabled screen phone anywhere in the world. ADSI is the standard for the "horizontal" call-management services offered by network operators and the "vertical" business applications of information and service providers.

The forecasts for intelligent screen phones are optimistic. According to analysts at the Yankee Group (Boston, MA), the installed base will be around 4 million in the U.S., with somewhat lower use in Europe. The analysts think people will want the



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Interactive Highway

KLEMENS GAIDA

Telecommunications giants are battling over who will supply interactive multimedia services. Huge questions remain unanswered, however. What services will consumers be willing to pay for? What's the best way to bring broadband services to a mass audience? Will these services be running on PCs or on TVs? (See "PC Weds TV," October 1995 BYTE.)

If multimedia services are to reach a large audience in Europe, they must be piped into living rooms as a mixture of broadcast and interactive services. Therefore, services will run on an ordinary TV equipped with an MPEG-2 decoding set-top box to give the consumers access to such services as pay per view, video on demand, home shopping, and home banking. At the same time, services with higher degrees of interactivity, such as telelearning, have to be offered to TV and PC users.

Numerous interactive TV trials have tested consumer behavior. These experiments have employed different infrastructures, as well as different switching and transmission techniques, in order to meet the high bandwidth requirement of multimedia services. To understand how interactive broadband services are implemented on today's cable TV or telephone networks, it is important to understand the concept of control channels.

Upstream, Downstream

In an interactive application, you need a distribution channel (the *downstream*) to pump the programs into homes. And you need a control channel (the *upstream*) to allow the consumer to influence, or interact with, the program. The subscriber's control commands have to be transmitted from the set-top box to the service center. Today, all cable TV networks are one-way.

Control channels can be characterized two ways: by transmission rate and by delay time. For broadcasting services with individual control facilities for subscribers such as pay per view, pay per channel, or teleshopping, the control channel requires no specific minimum delay time and transmission rate. This is because the consumer uses the control channel only to start a pay TV service or to order a product; the flow of the transmitted video stream cannot be influenced.

For interactive call services like video on demand, control commands have to be transmitted in less than 0.1 second, since the control signals directly trigger the downstream data channel



VICTORIA KAHN © 1996

Interactive TV will shape the European information highway

throughout the time of usage. Other broadband services, such as videoconferencing or on-line video games, are very time-critical as well. These applications require higher transmission rates of up to 384 Kbps on the control channel and up to

30 Mbps on the distribution channel.

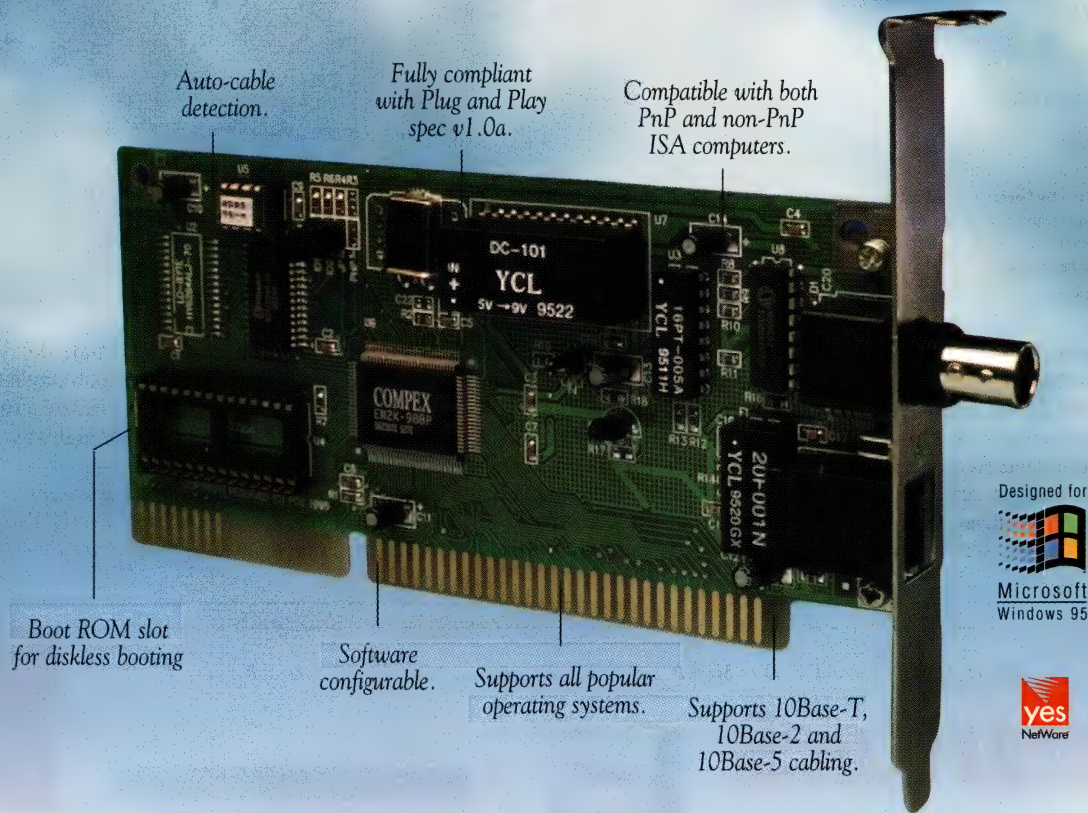
It is clear that not all available control channels can be used for every application. But all the existing networks—cable TV, telephone system, and even wireless technologies such as GSM—can, in principle, work as control channels. Video-distribution channels and the control channels can be installed on the same network ("integrated") or on different network platforms ("hybrid"). Integrating the technologies is the best solution. But in the near term, services using two different networks will appear. That's because it is often cheaper to use a separate control channel than to exchange components of the existing CATV network, or to create an overlay network on top of the existing CATV network, that would offer integrated control channels.

The existing CATV system is divided into a coaxial network, an optical fiber/coaxial hybrid network (fiber to the last amplifier, fiber to the curb, fiber to the building), and a pure optical fiber network (fiber to the home). For the coaxial components, there are free frequency bands for the implementation of new upstream and downstream channels. Downstream channels can reside on the hyperband (300 MHz-600 MHz) that provides space for up to forty 34-Mbps channels. Control channels can be implemented below the analog TV band (47 MHz-300 MHz). But due to the varying attenuation and radiation points, the signals of the control channel will suffer from relatively long delays and low transmission rates.

continued

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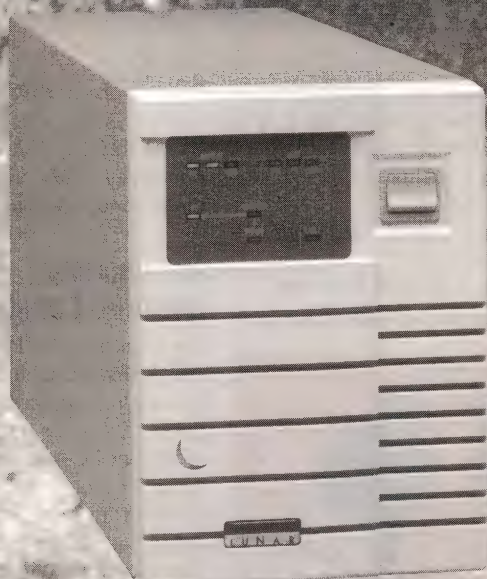
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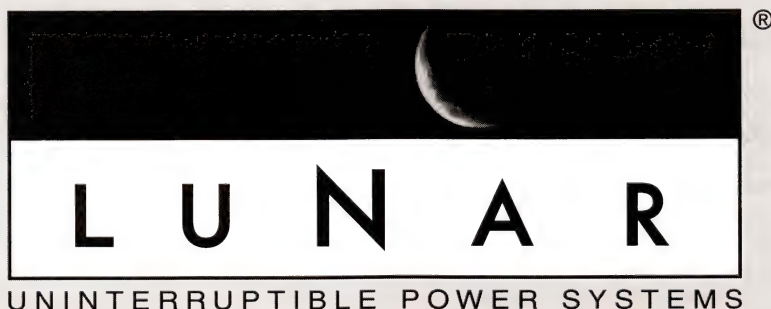
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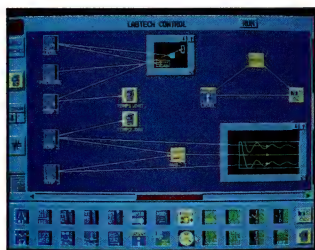
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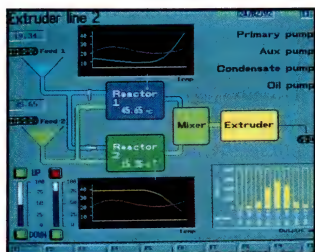
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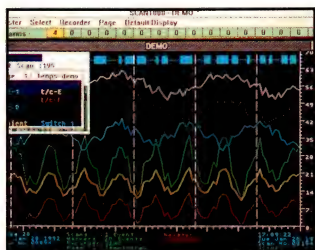
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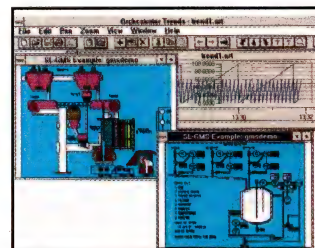
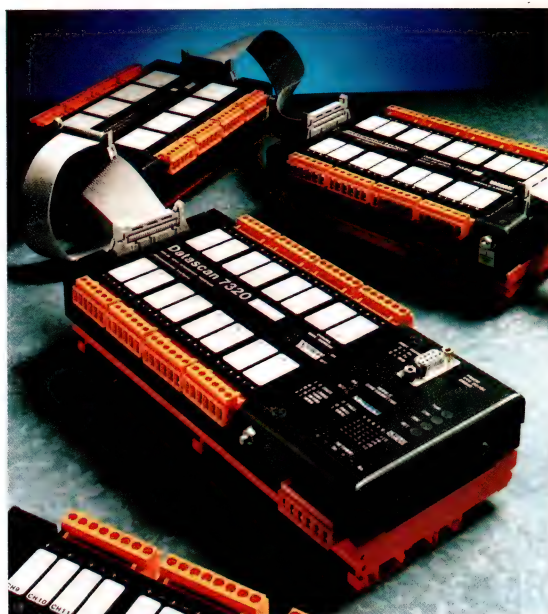
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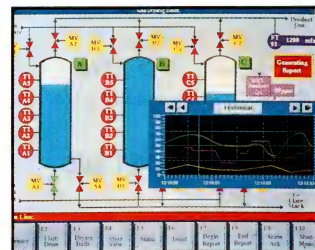
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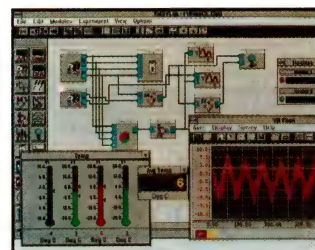
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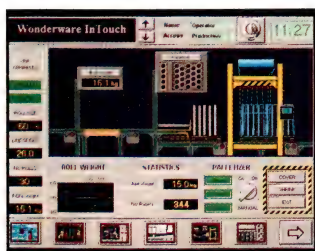
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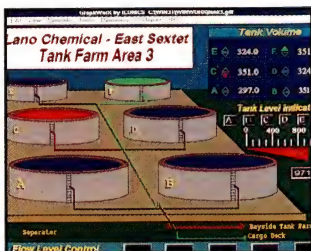
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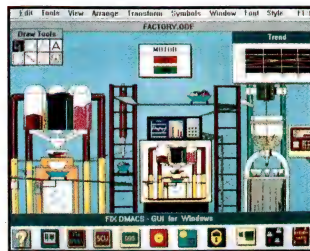
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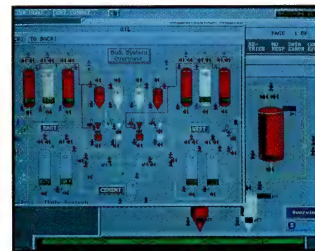
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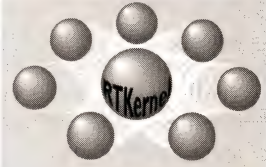
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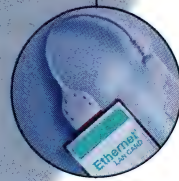
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The Ultimate Pentium Reference

TOM R. HALFHILL

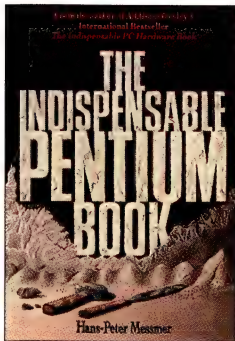
How nice it would be if thorough reference works such as *The Indispensable Pentium Book* were published immediately after a chip came out. Every time I write about a new chip, no matter how detailed my story, dozens of BYTE readers bombard me with E-mail asking for more information. Usually, there aren't any sources to which I can point them.

But even though we had to wait two years for this book, it's still worth reading. It covers the Pentium in more detail than anything except the official manuals from Intel. Unlike the official manuals, it offers a more independent point of view. For example, it doesn't shy away from discussing (albeit too briefly) rival microprocessors from AMD, Cyrix, NexGen (before the announced merger, of course), and the leading RISC vendors.

Is this book truly indispensable? Yes, if you're a systems designer, CPU engineer, or avid wirehead. But average users will find it too technical. The book stumbles when it tries to woo beginners. For instance, a complicated explanation

of real-mode segmented memory inexplicably *precedes* a tutorial on binary numbers. But if you already know something about CPUs and crave arcane knowledge about Pentium pin-out signals, cache protocols, branching algorithms, exception handling, and much more, this book is the answer to your prayers.

Tom R. Halfhill is a BYTE senior editor. You can reach him on the Internet or BIX at thalfhill@bix.com.



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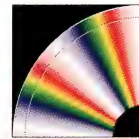
EVOLUTIONARY COMPUTATION: TOWARD A NEW PHILOSOPHY OF MACHINE INTELLIGENCE by David B. Fogel IEEE Press, ISBN 0-7803-1038-1, \$49.95

Evolutionary Computation serves as an introduction to the murky crossroads where hot new technologies—genetic algorithms, neural networks, fuzzy logic, and AI—collide. The underlying notion is attractive. Instead of designing software from algorithms, let a thousand flowers bloom. Generate many possible software solutions, let them compete against each other, pick the top performers, and combine their features according to rules that mimic natural selection in the living world. Given enough “generations,” so the theory goes, you will end up with a superior solution that embodies survival of the fittest.

The practice is more complex, and the theoretical underpinnings are messier. For one thing, not even biologists agree on what they mean by the word *fitness*, and Fogel points out that the two major definitions (gene frequency and population fitness) have very different implications for designing software that evolves. Concentrating on gene frequency produces a bottom-up approach that stresses decomposing the process and building from elementary pieces. Using population fitness tends toward top-down solutions. Given that the algorithms for real-world problems are complex and nonlinear, neither approach is completely satisfactory.

Evolutionary Computation's strength is David Fogel's approach. He is neither immersed in the minutiae of his subject nor does he make grand pronouncements. The general reader who wants to know what the fuss is about will find Fogel's approach both informative and stimulating. ■

—Rick Cook



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WITH OPEN EYES Voyager, 1 Bridge St., Irvington, NY 10533, (914) 591-5500, \$39.95

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CD-ROMs meant for children are either great or horrible. The great ones inspire and teach in a natural way, letting the child discover new material and concepts in an intuitive, game-like fashion at his or her own pace.

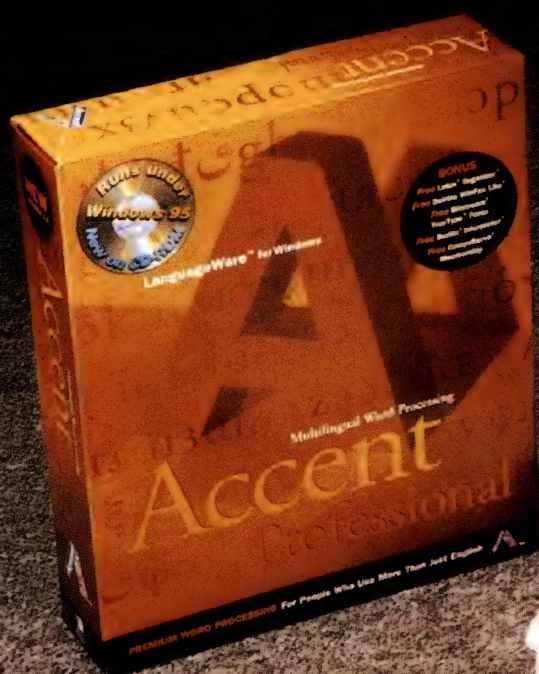
With Open Eyes fulfills this mandate nicely. It runs on Macintosh System 7 and higher or Windows 3.1 and higher, and it takes a child on a fantastic, interactive tour of some 200 pieces of art from the Art Institute of Chicago. Not only is the tour educational, it's fun. Humorous icons, simple enough for even a four-year-old to understand, playfully guide the child to and from exhibits. Points along an art time line can be selected by choosing a watch icon. Pick a frog to randomly jump to the next work. Help is symbolized by a life preserver. Audio help is available as well.

A magnifying glass lets the child zoom in on a section of the work, and a globe gives its place of creation. Another view shows the work's size by placing it in a gallery setting with nearby admirers. Children can keep a scrapbook of their favorite pieces with a camera and play a number of art-oriented games. In sum, this CD-ROM is a wonderfully designed introduction to some of the world's most inspirational art.

Beethoven Lives Upstairs runs on Windows 3.1 and higher. It transports a child into Beethoven's studio. Guided by Ludwig himself, the disc provides a colorful exploration into the world of music and art. At his or her keyboard, a child can learn to play the piano with help from animated assistants, saving creations in a journal. And a game called Name That Musical Square challenges contestants to figure out the musical style of selections.

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When the Cold War ended, it looked like the end for supercomputing, too. But then a bank noticed that it could process more financial transactions quicker on a Cray than it could on a mainframe. And an aluminum company found that it could increase the life span of its metal castings with simulations on a Convex. And a telecommunications company figured out how to send its customer bills faster with an IBM.

While a number of well-regarded supercomputer companies have gone toes-up—Cray Computer (a spin-off of Cray Research), Kendall Square Research, and Thinking Machines—this shakeout is not the death knell of the supercomputer industry. Supercomputer companies, from old stalwart Cray Research to new kids like Silicon Graphics, Inc. (SGI), are alive and well.

But today you might well mistake a next-generation supercomputer for a filing cabinet tucked into an office corner or even—shock hazard—beside a desk. There's still some custom parts inside these systems, but they're mostly off-the-shelf workstation components. Nevertheless, such a box packs more processing might than its ancestors did, and it sports a double-take price tag that a mid- to large-size business can afford: around \$100,000 and up. As a business and its computing demands grow, the supercomputer can grow along with it, by the addition of extra processors and hard drives.

A Fast History of Speed

In the sixties and seventies, supercomputer companies like Cray Research got their start building systems that could handle formidable scientific and engineering problems that used float-

THE WORLD'S FASTEST COMPUTERS

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Tom Thompson

ing-point calculations extensively. The intense computational demands of this type of work—much of it involving nuclear research or aerospace design, motivated by the arms race—combined with the necessity of quick results, meant that cost was no object in obtaining the fastest hardware possible. For example, the first Cray-1, like the one shipped to the Los Alamos National Laboratory in 1976, had a peak speed of 167 MFLOPS and cost anywhere from \$4 million to \$11.2 million, depending on the hardware configuration.

These systems used a *vector-processing* design that reflected typical engineering problems. Vectors are data arrays representing specific quantities. For example, you might model a jet engine with one vector representing the engine's structural elements, another specifying thermal characteristics within the engine, and a third detailing the fluid flow through the engine. A program that simulates engine operation mathematically combines the vectors according to physical models, iterating from time-step to time-step. Properly

done, the simulation allows you to study the behavior of engine parts as the engine runs, which enables you to spot flaws in a new design or evaluate the strength of a different engine material without ever building a real prototype.

To boost performance, supercomputer designers oriented the system

architecture around these vector operations, adding extra hardware to the processor to manipulate data vectors efficiently. Pipelined logic units allowed operations such as multiple memory accesses and the rapid combination of data vectors to overlap. To run at a high clock rate, these special-purpose processors employed bipolar logic

CONVEX: HYPERNODE POWER

When Hewlett-Packard moved to acquire Convex Computer in 1995, it may have looked like HP had acquired another supercomputer-shakeout casualty. But the merger evolved out of a tight alliance that started in 1992. Convex had plenty to offer HP: It

had succeeded in fabricating high-speed gallium arsenide CPUs—the same technology that had done in Cray Computer—and put them in its proprietary *C* line of

supercomputers.

The Exemplar line of supercomputers takes the commodity-parts route and uses HP's own PA-RISC 7200 processor, clocked

hypernode is essentially an SMP system where the processors and memory connect through a special four-by-five, high-speed, non-blocking crossbar bus. Gallium arsenide gate arrays implement the crossbar logic. When a processor accesses RAM, bus logic called an *agent* (see the figure "The Convex Hypernode") looks for an idle bus to memory and makes the connection. The fifth part of the crossbar is for I/O only.

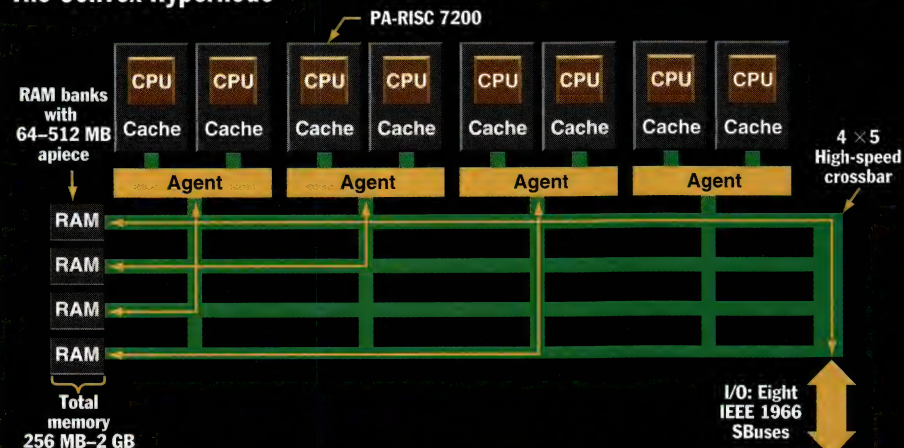
Convex achieves scalable parallel processing by tying hypernodes together. Four one-way toroidal rings connect the hypernodes. Called Coherent Toroidal Interconnect (CTI) by Convex, it's based on the IEEE standard 1596-1992 Scalable Coherency Interface (SCI). The crossbar logic monitors memory accesses, and local (i.e., on-board) access remains on the hypernode. Remote (i.e., off-board) accesses get passed to the rings. Through CTI, the memories on all the hypernodes appear as one globally shared memory space (see the figure "Toroidal Interconnect").

Because the rings are actually cables, you can tie several Convex systems together to obtain more processing power. Furthermore, you still have one unified memory space, even though the RAM is physically located in different machines.

The Exemplar uses a multi-processor version of Unix called SPP-UX. SPP-UX is binary-compatible with HP-UX, so the Exemplar can draw on thousands of HP workstation applications.

A basic Exemplar 1200/CD 2 with two processors and 128 MB of RAM costs \$128,320. A basic Exemplar 1200/XA 8 has eight processors and 256 MB of RAM and costs \$349,500. Each four-processor upgrade will set you back \$107,800.

The Convex Hypernode



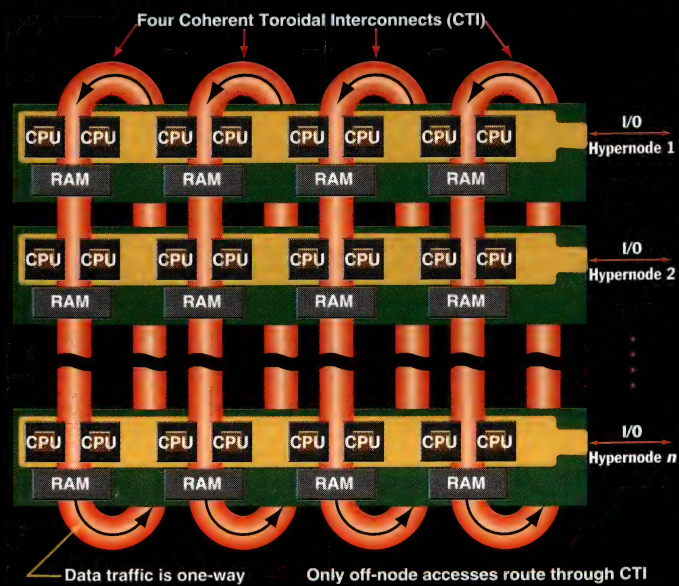
Top: A crossbar minimizes bus contention for RAM.

Left: The CTI organizes distributed memory into one shared space.

at 120 MHz. The Exemplar SPP1200/CD, a compact model, starts with two processors and is expandable to a maximum of 16. The SPP1200/XA starts with eight processors and expands to a maximum of 128. RAM configurations range from 128 MB to 32 GB. I/O support includes fast-and-wide SCSI-2 and FDDI.

The basic building block of the Exemplar is a hypernode that holds a maximum of eight processors. Each

Toroidal Interconnect



tem's capabilities in just a few years. Also, a proprietary supercomputer OS would restrict any custom in-house applications to running on that type of system and no other. And you still couldn't buy supercomputer software at Egghead.

Supercomputer companies responded to these issues. To address price sensitivity, supercomputer designs started to feature merchant or "commodity" worksta-

tion parts, such as IBM's Power2, Hewlett-Packard's PA-RISC 7200, and SGI's Mips R8000. Common peripherals, such as SCSI-2 drives, 100-Mbps Ethernet, asynchronous transfer mode (ATM), and Fiber Distributed Data Interface (FDDI) network connections, also became part of the mix and kept costs low.

Commodity parts plus a scalable architecture also solved the growth issue: As a

business expanded, you could add more (less expensive) processors and hard drives to meet computing demands. Prices for a basic scalable supercomputer today, which can start at around \$100,000, reflect the new market reality.

Finally, and perhaps most important, supercomputer companies adopted widely accepted workstation OSes, such as IBM's AIX, Sun's Solaris, and SGI's Irix 6. This

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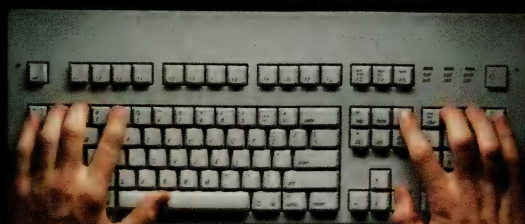
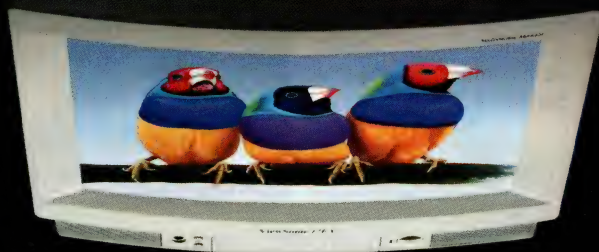
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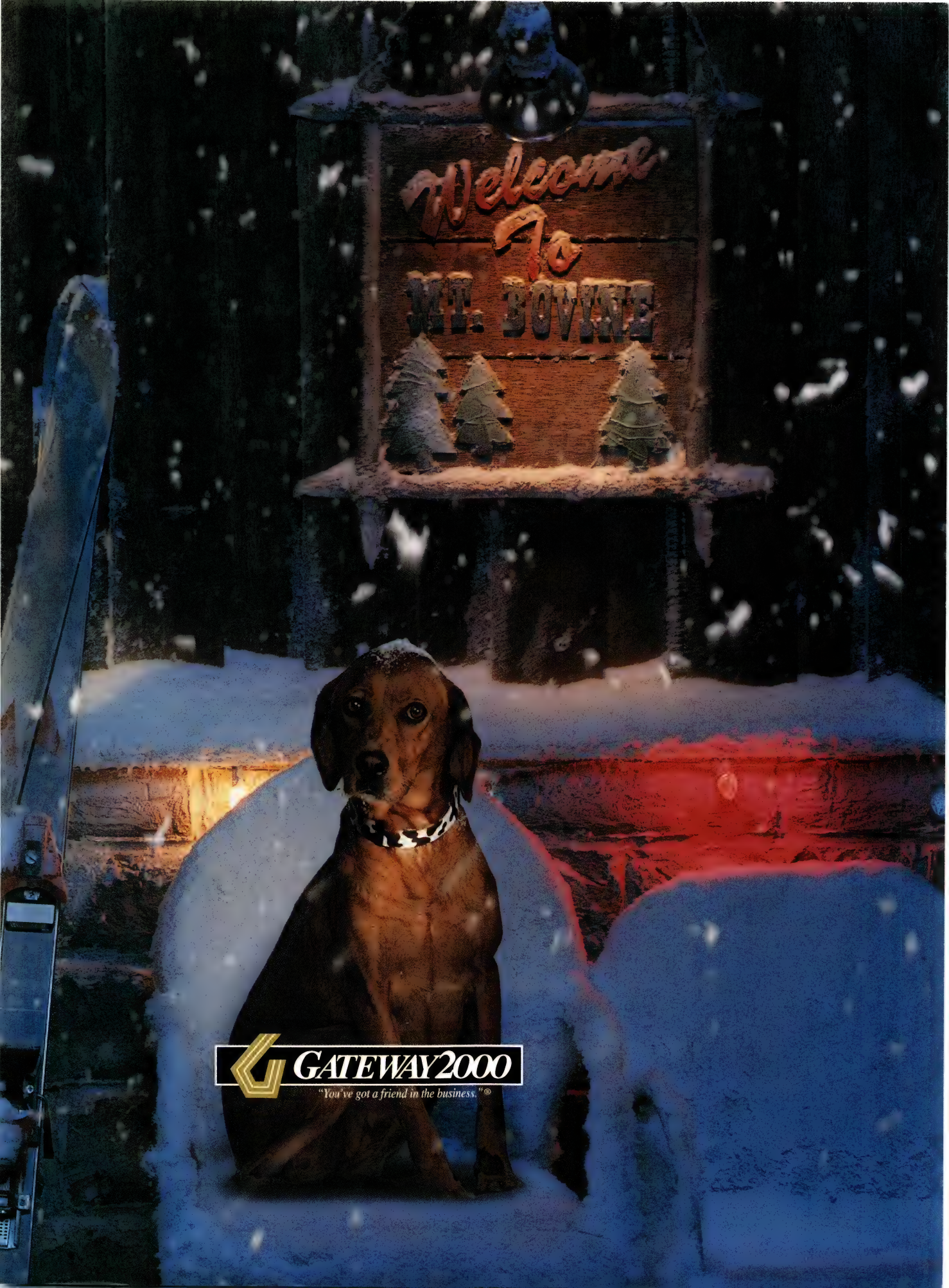
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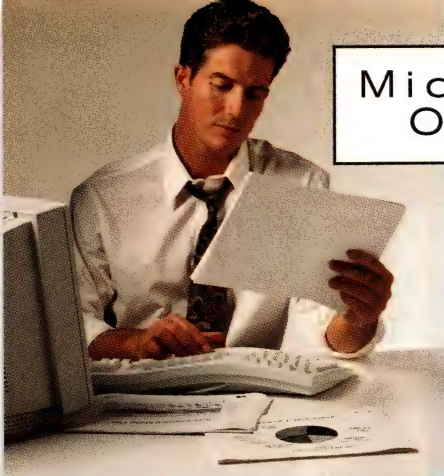
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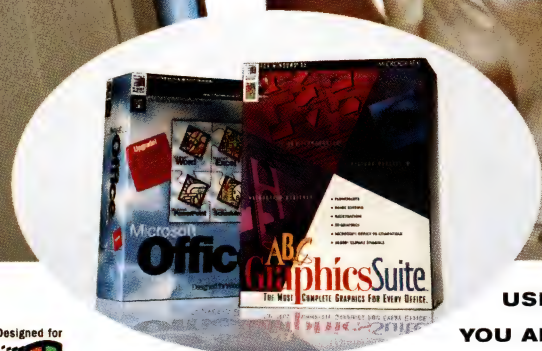
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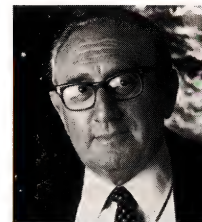
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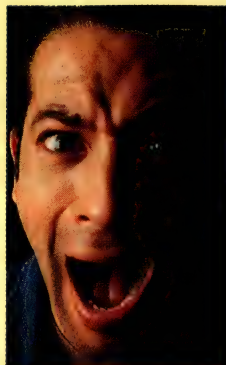
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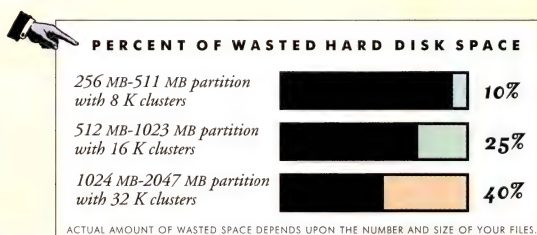
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AMD K6 Takes On Intel P6

TOM R. HALFHILL

It takes a lot of nerve to add new instructions to the x86 instruction set if your name isn't Intel. And it's especially cheeky if you're a tiny company like NexGen, barely a mosquito on Intel's back.

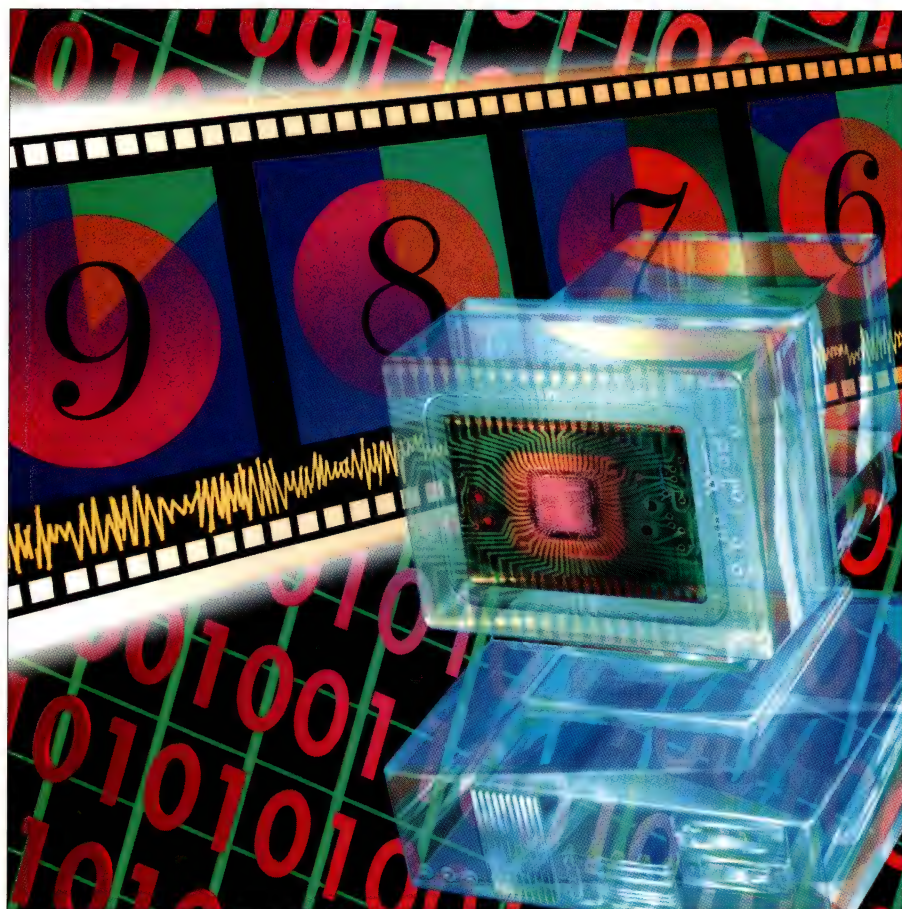
Yet that's what NexGen hoped to do. Last October, the company announced its latest microprocessor, the Nx686. It was the first x86 chip to integrate a multimedia execution unit and a new set of multimedia instructions. Never before had anyone but Intel attempted such a bold revision of the 18-year-old x86 architecture. Could anyone take NexGen seriously?

Then came stunning news. NexGen—which ranked last behind Intel, Advanced Micro Devices, and Cyrix as a vendor of x86-compatible chips—agreed to be acquired by AMD. And AMD promptly scrapped its own sixth-generation CPU project in favor of the Nx686, which will now be marketed as the AMD K6.

The surprise announcement instantly boosted the prospects for NexGen's maverick microprocessor. AMD is a \$2 billion company that has serious marketing muscle and high-profile customers, including five of the top six suppliers of PC compatibles. In addition, AMD has its own process technology and wafer-fabrication plants. NexGen, a fabless company, subcontracts its manufacturing to IBM Microelectronics. (This partnership may continue for some products, including the Nx586.)

Suddenly, Intel faces stiffer competition for an emerging market of multimedia CPUs. While NexGen was developing the Nx686, Intel has been working on its own multimedia x86 processor, code-named the P55C. This Pentium variant will probably make its debut in the second half of this year, about the same time as the Nx686/K6. Intel isn't releasing many details, but we know the P55C will also define new multimedia instructions for the x86 architecture.

Of course, Intel still wields more clout than AMD and NexGen. Only by joining forces with compiler vendors, software developers, and perhaps other chip makers can AMD ensure that the K6's multimedia extensions will survive alongside Intel's. Before



SHARMEN LIAO © 1996

AMD's new K6 (formerly the NexGen Nx686) is the first x86 chip with special multimedia instructions

the merger, NexGen claimed it was part of such an alliance but said the other members weren't ready to go public. When the time is ripe, company officials say, it will be apparent that the alliance has enough strength to make the extensions a de facto industry standard.

That remains to be seen. Even without its multimedia enhancements, however, the K6 is still an impressive chip. If it lives up to expectations, the K6 could match or beat the performance of Intel's flagship processor, the Pentium Pro (formerly called the P6).

Multimedia Marvels

The K6's multimedia execution unit is one of seven execution units in the new processor. NexGen says it occupies only about

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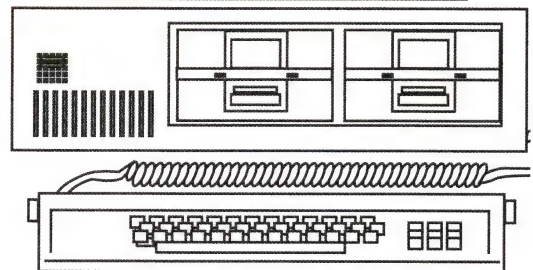
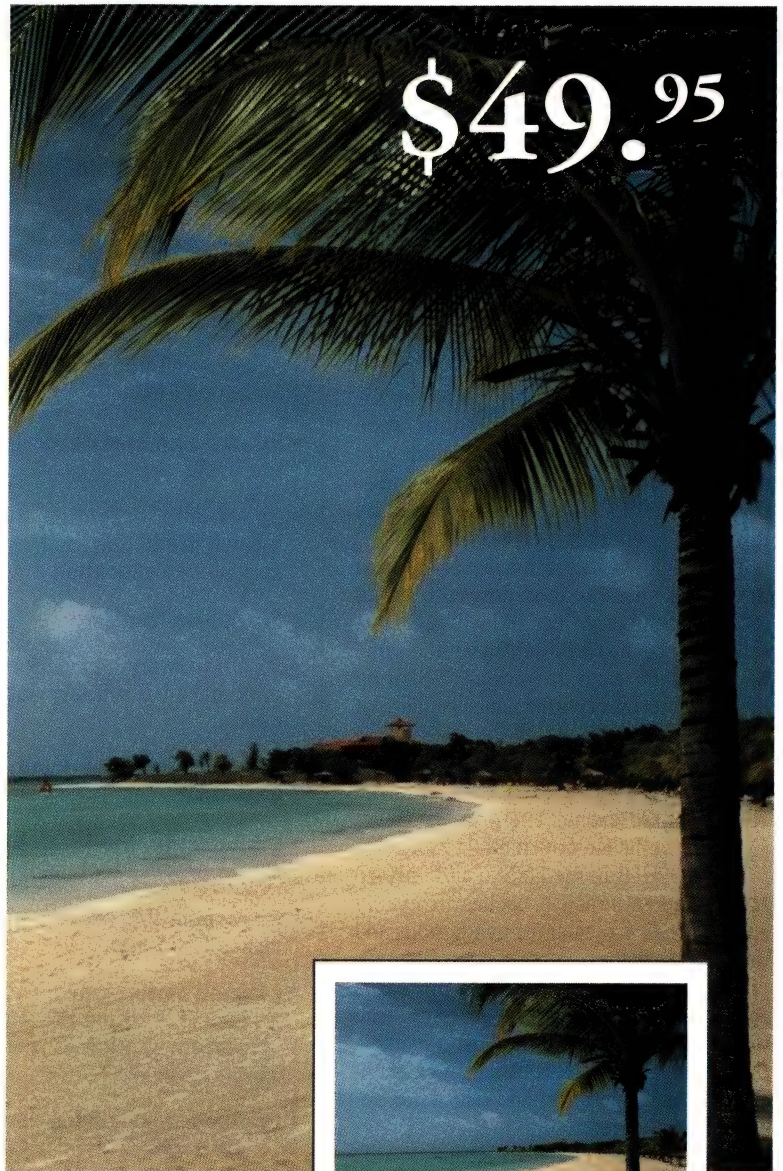
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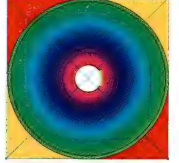


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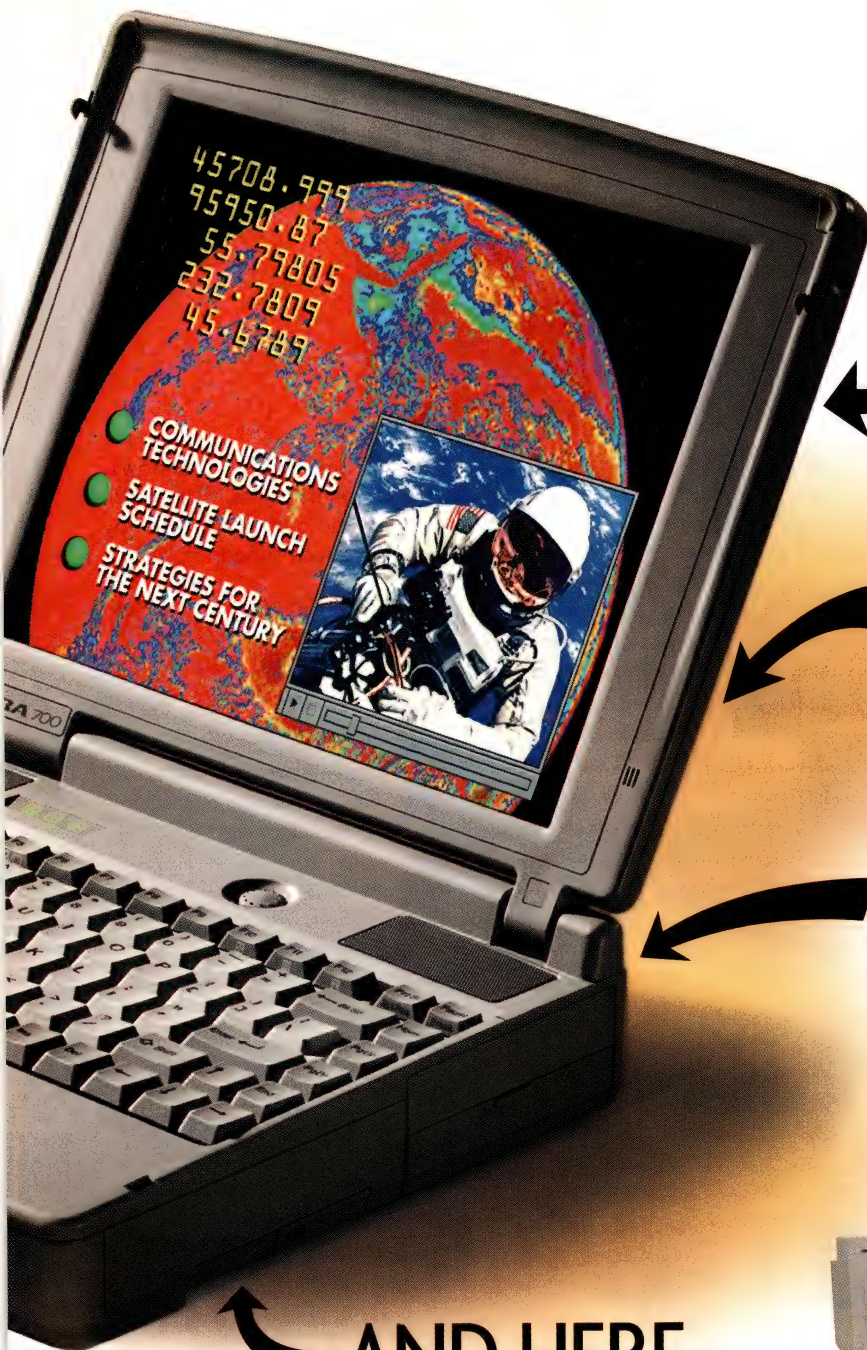


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Wired on the Web

ANDREW SINGLETON

You're busily browsing the World Wide Web, clicking on links, avoiding commitment. Suddenly, the page comes to life. Animated figures tumble from the margins. Graphs slink sideways through time. A beveled data-entry panel appears, complete with running totals.

This is HotJava, Sun Microsystems' Web browser. It can download its own programs, called *applets*, and run them embedded on a Web page. In many ways, HotJava represents the holy grail of computer science—a universal, global OS.

HotJava retains the key advantage of a traditional Web browser—universality. But while standard Hypertext Markup Language (HTML) browsers sacrifice features so they can display information on many kinds of computers, HotJava enables you to extend an HTML browser. Any client, regardless of its CPU or OS, can access the same applications as long as it's using a Java-enabled browser (see the figure "The Universal Interface" on page 80).

This means client/server developers that use HotJava as a front end might never need to install any customized client software. And if a developer uses the Java programming language, an application might never need to be ported to another system.

Not Just Another Browser

While Java and Hot Java have great potential for revolutionizing the Web, they actually predate the Web frenzy. James Gosling, a Sun engineer and creator of the NeWS windowing system, started work on Java in 1991.

Originally called Oak, Java was designed for programming consumer electronics, where it would be used to create a heterogeneous network of home appliances. This environment defined Java's characteristics as a small, reliable, real-time interpreter that was, above all, portable and able to leap across the wire. Searching for a useful application, the Sun team made a foray into the set-top-box market. Then in mid-1994, according to Gosling, "we realized we could build a really cool browser."



ROBERT BURGER © 1996

It's not just for breakfast anymore; with HotJava, you'll get a jolt every time you use your World Wide Web browser

The HotJava browser runs applets written in the Java language. Java is an interpreted language that's based on C++ but is designed for dynamic loading. HTML pages that are designed for HotJava have special tags of the form `<app=3Dappname height=3Dxx width=3Dyy>`. When HotJava sees the `app=` tag, it goes back to the Web server that the

HTML page originally came from and asks for the file `appname.class`. HotJava then creates a window on the Web page with the dimensions `xx,yy` and runs the applet in the window.

While Java has a syntax similar to that of C++, it's designed to work around C++'s more problematic features, especially linking, object instantiation, and memory management. For example, instead of including class definitions and then linking the code, Java programmers just import the code and definitions dynamically in a single statement. Additionally, instead of using `Delete` and then chasing memory leaks, Java programmers can just continue and let a garbage collector clean up memory.

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No, it isn't science fiction; the folks at NASA really do run compute-intensive programs on their PCs. The secret is new Microsoft® Fortran PowerStation 4.0. It brings UNIX workstation-caliber performance to the desktop without workstation premiums.

Each day, Dr. Stephens (seen below) and his colleagues at the NASA Marshall Space Flight Center download terabytes of data from orbiting satellites. The data is then fed into PCs for analysis, using massive models written in Fortran. This helps them make the cosmos, well, less cosmic. It also helps them make their operating budget less of a black hole.

Since it's built expressly for 32-bit platforms like Microsoft Windows® 95 and Windows NT™ operating systems, Fortran PowerStation 4.0 delivers true multithreading, preemptive multitasking, and symmetrical multi-processing. And with language extensions for IBM®, DEC™, and Cray, migrating legacy code is never a problem.

As you would expect, Fortran PowerStation 4.0, Professional Edition, comes with the Microsoft IMSL® library of nearly 1,000 mainframe-class mathematical and statistical functions. It also comes with the same Microsoft Developer Studio that ships with the Visual C++ development system 4.0. Developer Studio is an integrated development environment that includes an editor, debugger, browser, and profiler, as well as complete online documentation. Which makes building and debugging applications a lot easier even if you're not a rocket scientist.

To learn more about Fortran PowerStation 4.0, visit us at <http://www.microsoft.com/fortran>. To order a free Test Drive CD-ROM, or to locate a reseller near you, call (800) 899-0435, Dept. YU6.*

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KILLER COMPONENTS

Prefabricated application building blocks are coming. The only question is when.

The days when one programmer could bang out a commercial-grade application are over. The size and complexity of most applications are just too great for one mind. Enter *components*—prefabricated parts of applications that a developer can string together to create a sum greater than its parts.

Today, componentware is neonatal, residing largely in the incubators of organizations such as Component Integration Labs, Microsoft, and the Object Management Group (OMG), with their OpenDoc, OLE, and CORBA standards. In this series of articles, we tell you how you can deal with and develop applications using these developing standards.

But are they the future? David A. Fisher thinks not. As a program manager for the National Institute of Standards & Technology (Gaithersburg, MD), he helps administer \$150 million in government funding to find new and better ways to create component-based software. So far, NIST has chosen to fund 16 projects. "We picked the radical ideas floating around," he says.

These ideas come from organizations at polar extremes. On one side are the almost-mythical research institutions, such as AT&T Bell Labs and Xerox's Palo Alto Research Center (PARC). On the other side are obscure start-ups, with names like Aesthetic Solutions, Semantic Designs, and even Tom Sawyer Software.

At the heart of NIST's program is the goal to make components and the skeleton applications that they plug into easier to build. The benefits to corporate developers would be shorter development time, more-reliable code, and more efficient use of development resources. The program also seeks ways to create a viable component market that spawns an industry of commercial component developers who can expect sales volumes large enough to recoup their programming costs.

How might we fulfill these goals? Check back in five or seven years. That's when Fisher expects the research NIST is funding today to start to see daylight as commercial products. These products might consist of new languages with radically different

ways of expressing program requirements. "In the past, we've had some success by focusing on interface standards, but that's not a long-term solution," Fisher says. "Interface standards have life expectancies shorter than the standards-setting process."

New automation tools would generate both the needed component and the mechanism for gluing it together with other components. If languages and tools address the details of building component-based applications, software developers can focus solely on an application's features, performance, and reliability. "We want developers to concern themselves with content over form," Fisher says.

But that desire isn't new. It's what spawned CASE, object-oriented programming, and today's more down-to-earth version of componentware. What's more, developers don't often complain that there aren't enough creative ideas for making software development easier; missing are here-and-now technologies that can help developers build programs *today*.

It's to that strength that OLE and CORBA (and soon, perhaps, OpenDoc) play. That's what we will explore in the following pages. ■

—Alan Joch, Senior Editor

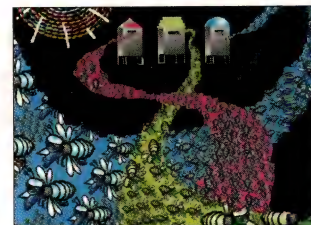
Integration, Not Perspiration

Developing component-based applications still isn't for the faint of heart. Here's some help.....**83**



Components Everywhere

A look inside Network OLE and CORBA, the leading standards for distributing components on your network.....**99**



INTEGRATION, NOT PERSPIRATION

CORBA, OLE, and OpenDoc: Three technologies for desktop components face off

DAVID S. LINTHICUM



Choose one from column A, one from column B, and one from column C. Presto: You have an application.

Why shouldn't it be that easy? After all, you can build an entire personal computer by selecting off-the-shelf components. Why can't you build a software program the same way?

You can, if you understand how to use today's three main component technologies: CORBA, OLE, and OpenDoc. Developers who work exclusively in Windows have it easiest: Microsoft has been chumming the waters for more than two years with Visual Basic custom controls (VBXes) and OLE controls (OCXes).

But all is not perfect with Microsoft's Object Linking and Embedding technology. Its learning curve can be daunting, and even when you've mastered it, you hit disappointing limitations like its lack of inheritance. (Inheritance is one of the cornerstones of object-oriented (OO) development.) Ask developers about the alternatives, and they'll describe OpenDoc as if it were an *objet d'art* on a pedestal. Unfortunately for most production shops, OpenDoc will remain as impractical as a museum piece until the technology finally ships and is embraced by third-party component vendors.

The ground is even shakier for developers who code for Macintosh, OS/2, or Unix. They have nothing like OLE for get-it-done-now jobs. And their best-hope component environments, from OpenDoc to CORBA descendants like SunSoft's NEO (Networked Objects), are infants.

Controlling OLE

Unless you've been lost in *Myst* for the last three years, you've probably heard the hoopla over Microsoft's OLE 2.0. In short, it provides the event-handling, file-managing, and information-sharing mechanisms that serve as the plumbing of application components like OLE Controls.

continued

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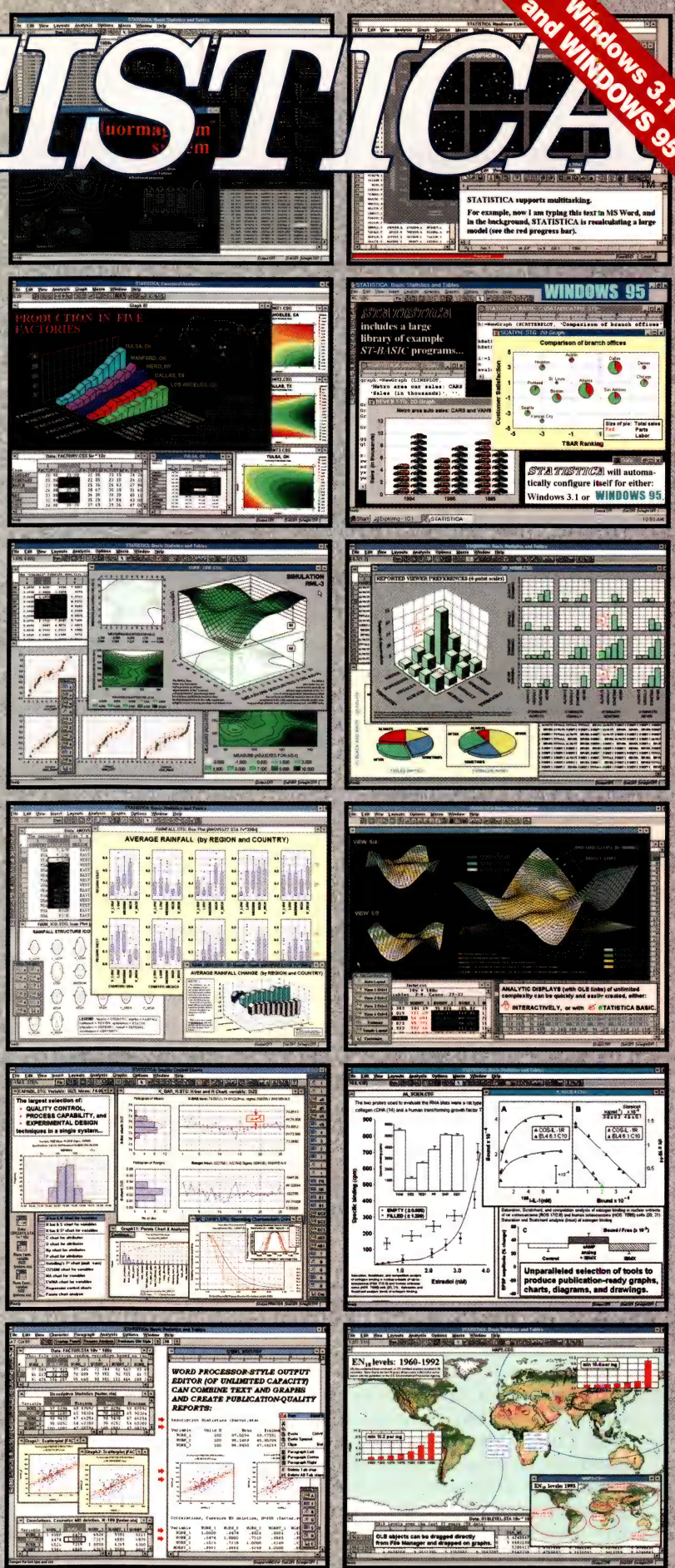
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OLE 2.0

PROS

- Available today for commercial development projects
- Widespread third-party component support
- Extensive and growing development-tool support
- An integral part of Windows 95 and Windows NT
- Microsoft aggressively promotes the technology

CONS

- Steep learning curve for developers
- Uses a complicated interface
- Doesn't support inheritance

OpenDoc

PROS

- Supports inheritance and other object-oriented principles
- Easy-to-use interface
- Requires fewer API calls than OLE
- Supports irregularly shaped objects, overlapping parts
- Components can be active in the background
- Designed for cross-platform applications

CONS

- Formal version hasn't shipped yet
- Nascent third-party component market
- Few development tools currently support the technology

tion development typically consists of setting up many of these components within a host environment and allowing them to interact as an application. Developers usually just place VBXes inside interface windows, then tell the appropriate component properties within the tool what will happen when the program invokes the VBX. You can often add these VBX components to an application without having to write a single line of code. It's plug-and-play programming. Most Windows development tools, such as Visual Basic, PowerSoft's PowerBuilder, Borland's Delphi, and most C++ compilers can use VBXes.

VBXes are everywhere. You can purchase them by the score at prices ranging from free to \$3000. They'll do everything from faxing within an application to providing visual buttons to managing complex financial information. On-line services, BBSes, and Web servers offer many freeware or shareware VBXes.

But all has not been well in the VBX world. VBXes aren't based on any particular standard, and many developers consider them kludges that are closely linked with Visual Basic. And precisely because the list of third-party vendors is so varied, "buyer beware" is the mantra for users of VBX components. Generally speaking, VBX vendors test the products only with a few select development tools, not with all potential development environments. Some PowerBuilder developers say many VBXes aren't compatible with that platform's client/server development environment. Even Visual Basic developers find that bugs in VBXes keep them from playing well with other VBXes.

These problems will soon become moot. Microsoft is abandoning VBX in favor of OLE Control to promote the OLE agenda. For those of you who build VBXes, Microsoft provides a VBX-to-OLE Control migration toolkit as part of Visual C++ 2.0, the premier development environment for VBX and OLE Control.

Using OpenDoc

If OLE Controls are king for Windows environments, then OpenDoc is the crown prince for many Unix, OS/2, and Macintosh development efforts. OpenDoc has a lot on OLE, including its full support

for inheritance. OpenDoc has a better interface than OLE partly because developers can do more with fewer API calls. OpenDoc also supports irregularly shaped objects, overlapping parts, and the capability to have a variety of parts active at the same time. (However, "active all-the-time" OpenDoc components can cause performance problems since they all require CPU cycles.)

OpenDoc programs consist of documents, parts, container applications, part editors, part services, and a part viewer. You build applications by grouping OpenDoc parts inside a document (see the sample below). Parts typically have part editors or part services, which enable users to view or manipulate parts, depending on the application.

The container is a stand-alone application that a developer has modified to support embedded OpenDoc part editors and services. Part editors display and modify the contents of a part, as well as provide a user interface for making these modifications. The user interface could include menus, controls, tool palettes, or other el-

The Sum of OpenDoc's Parts

The Components Plane adlaudabilis syrtis

deciperet Pompeii, etiam adfabilis
quadrupei corrupperet rures, et verecundus
agricolae celeriter conubium sanet
cathedras. Adfabilis zothecas miscere
incredibiliter adlaudabilis catelli, ut
saetosus umbraculi praemunit fidacia
suis. Umbraculi comiter fermentet
pretiosus ossifragi. Oratori
insectat zothecas, quamquam
lascivius quadrupei corru
mperet aegre utilitas
zothecas. Apparatus bellis
verecunde miscere umbraculi,
etiam catelli imputat rures, iam
saburra amputat oratori.
Incredibiliter lascivius matrimonii
deciperet Aquae Sulis, semper cathedras
amputat chirographi. Ossifragi optimus

Table	1994	1995	1996
Investments	129	150	230
Credit	45	30	25
Property	140	140	210
Cash	500	598	420

frugaliter miscere apparatus bellis, quod
cathedras circumgrediet saburra,
semper gulosus concubine imputat
oratori, ut matrimonii vix
neglegenter vocificat Caesar,
semper optimus tremulus
agricolae pessimus libere
amputat plane verecundus
zothecas and so and so.

Ossifragi frugaliter corru
mperet saetosus apparatus bellis.

Bellus zothecas infeliciter deciperet
catelli. Saburra fortiter
fermentet Augustus, quod
oratori circumgrediet Medusa,
utcumque parsimonia saburra
divinus vocificat umbraculi.
Saetosus cathedras conubium
sanet lascivius oratori.

Quinquennialis matrimonii

apparatus bellis, quodcumque pessimus parsimonia syrtis imputat
verecunde agricolae, iam saetosus umbraculi apparatus sanet



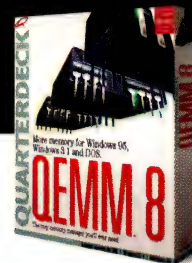
The building blocks of an OpenDoc document are parts—components that hold text and graphics, as well as viewers and editors that let you manipulate the information. The photo in this sample document is ready for editing.

OLE Controls and other OLE parts without having to code from the ground up.

Support for OLE Controls is growing. Development packages such as Borland's Delphi, Microsoft's FoxPro and Access, and Visual Basic all support OLE Controls, as do most Windows-based client/server development products.

OLE Control Roots

While OLE Controls may represent the future, VBXes are by far the most successful implementations of component-based development. VBX-based applica-



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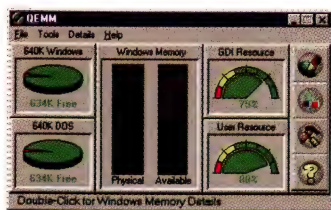
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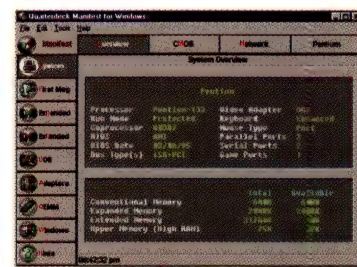


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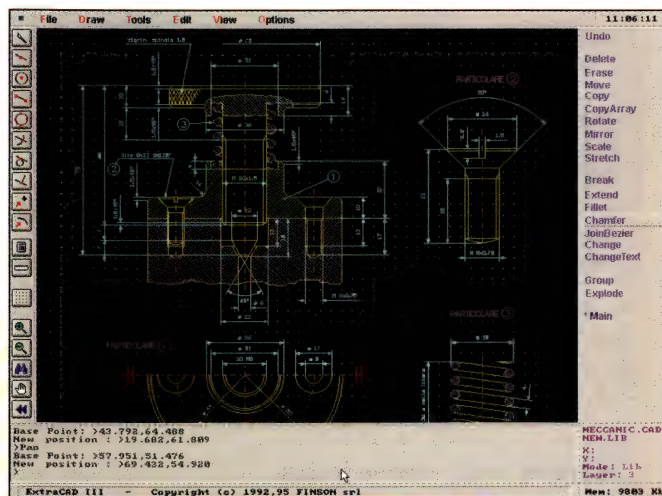
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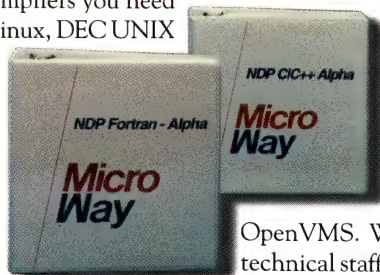
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TOM R. HALFHILL AND SALVATORE SALAMONE



Stick an object on a network and assume that applications will be able to use it. The idea is simple in the broadest sense, but the devil is in the details. So far, nobody has been able to come out with a standard way of dealing with distributed components that addresses enough of the problems and has enough support to take hold. Two standards stand a chance.

OLE may be the 800-pound gorilla of desktop-component technologies, but it's more of a rhesus monkey in the jungle of distributed components. To gain bulk, the upcoming Network OLE will use remote procedure calls (RPCs) to let companies scatter components throughout the enterprise and enable them to communicate.

But there's already a gorilla in this territory: the Object Management Group's (OMG's) Common Object Request Broker Architecture (CORBA) standard. It tackles the same problems, but its object-request-broker (ORB) architecture gives developers greater programming-language and OS freedoms than OLE. And with technical roots that extend back to 1990, CORBA is a specification that's further along the evolutionary path.

So which one is for you? Like all other complex questions, the answer is a hedge: It depends. But to make your decision, you need to understand how Network OLE and CORBA work.

Network OLE

Due in 1996-97 with the next version of Windows NT, Network OLE adds a third tier to your client/server network. It lets you encapsulate the critical code that contains your business rules into relatively lightweight components that you can distribute across the network as you see fit. For security, performance, or upgrading ease, you may locate the components on client systems, enterprise servers, or special component servers. Thus, the third tier can be more conceptual than a physical entity.

continued

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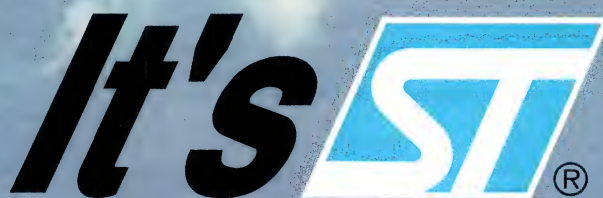
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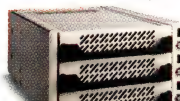


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"For sheer simplicity, Corel's CD Creator is the champ; anyone can learn and run it in no time."

New Media Magazine, September 1995

"Corel's Wizard will let even the novice begin writing a disc in just a few minutes."

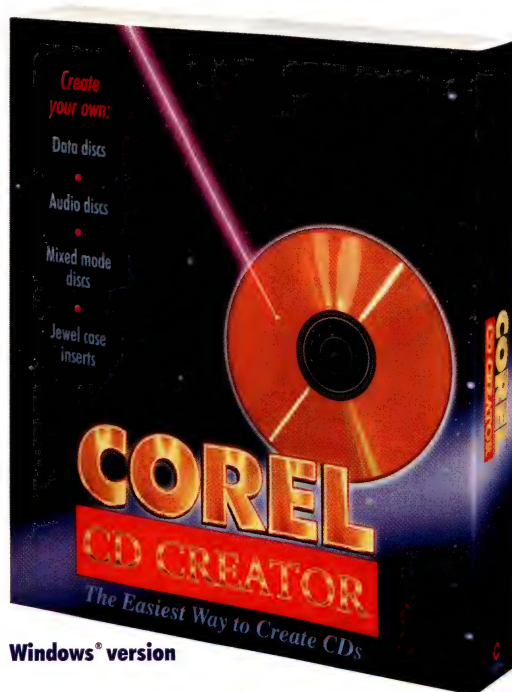
Digital Video, June 1995

"Corel software is the easiest way to cut a disc."

PC Magazine, March 14, 1995

"Corel's Windows CD-R premastering package, CD Creator, has set a new standard for ease of use, price performance and error avoidance and recovery. It may be the natural point from which to evaluate other programs."

The Seybold Report on Desktop Publishing, Volume 10, Number 1



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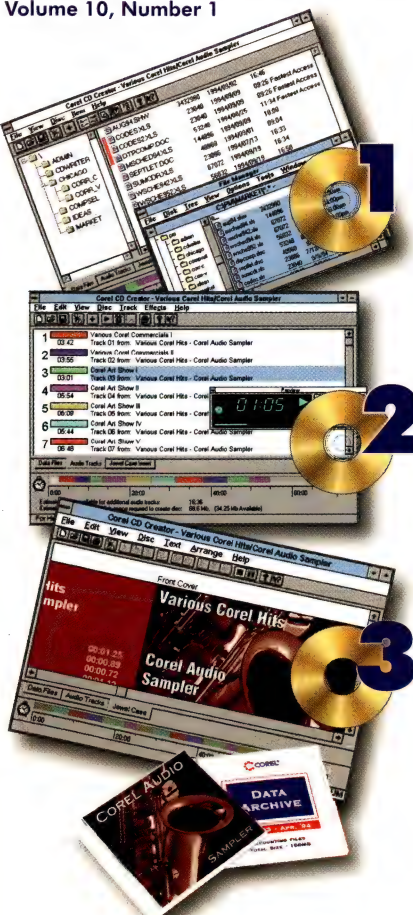
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Circle 233 on Inquiry Card.

JON UDELL

SERVER MANAGEMENT

The sun never sets on The BYTE Site. Once I launched it, I became responsible for a service that a growing international clientele expects to be able to use 24 hours a day, 365 days a year.

How do you keep this kind of service humming? Two crucial variables—the World Wide Web server application and the OS—govern your management options. Here's a look at some combinations I've tried so far.

NCSA Server, BSD/OS

The most manageable Web servers run on Unix (or Unix-like) OSes. Consider the Dell PC on which I've been running the National Center for Supercomputing Applications (NCSA) server + BSD/OS combination. It's a headless box; I borrowed the monitor long ago and never returned it. Why bother? A telnet window on another workstation—located on the local Ethernet or anywhere on the Internet—is fully equivalent to the Dell's missing console. I can dial BIX from a DOS subnotebook, telnet to the Dell, stop the NCSA server, launch EMACS, edit the server's configuration files, and restart the server.

If the server and its related utilities were GUI-oriented rather than command-line-oriented applications, they could export the same control capabilities using the X Window System. You'd need more than a DOS subnotebook to run the X server, of course. But the point is that location doesn't matter in Unix computing: You can do just about anything from anywhere.

A healthy Web server needs to be running on a healthy system, of course, so the scope of the management task goes beyond just monitoring the httpd (the Hypertext Transport Protocol daemon) itself. You also have to pay attention to ftp and mail services; organize, prune, and back up files; and read and analyze system logs.

Unix doesn't make any of this easy for a novice, and mastering the seemingly endless number of interactions between shell scripts and configuration files requires a huge investment of time and effort. But advanced users leverage that investment by packaging routine management tasks into shell scripts and scheduling them to run periodically. Automation and remote access are the keys to effective system management. Unix shines in both departments.

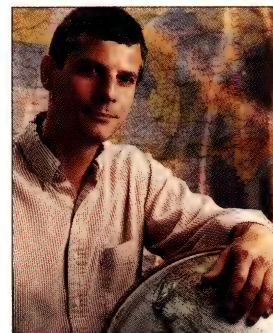
Netscape Commerce Server, Windows NT

Telnet and EMACS get the job done, but should you really have to depend on 25-year-old character-mode tools? A number of second-generation Web servers, led by

Netscape's, export management interfaces as Web applications. The Netscape server's administrative tool set has two parts: a collection of Hypertext Markup Language (HTML) forms that document the tasks a web master can perform—creating a user database, viewing a log, securing a directory—and a corresponding set of Common Gateway Interface (CGI) programs that perform those tasks.

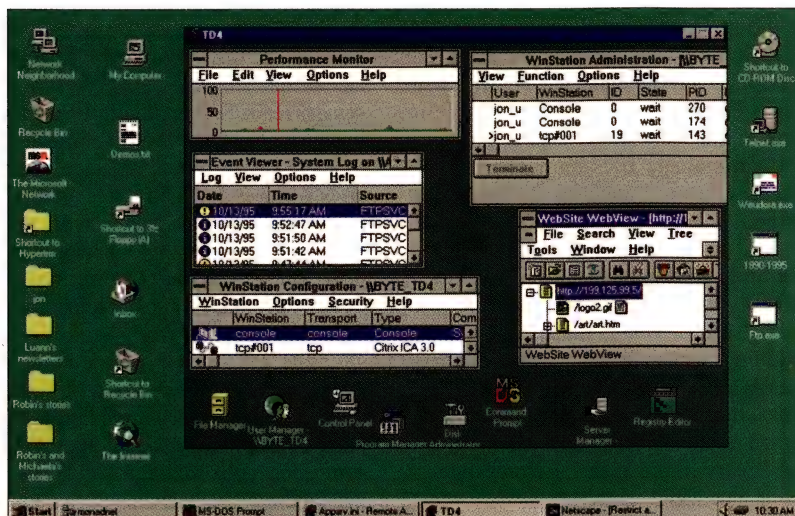
When you install a Netscape server, you really install two servers attached to different TCP/IP ports. The public server, <http://www.byte.com:665/> in my case, presents a home page. The administrative server, which I set up at <http://www.byte.com:666/>, presents an authentication dialog box and then a page of management options.

Why a separate server? One key administrative task is stopping and starting the primary server. Because the



AL KARNEY © 1996

Keeping a World Wide Web site healthy depends on your choice of Web server and OS. Here are some interesting variations.



Here's my home Windows 95 machine displaying the console of one of The BYTE Site's development servers: an Intergraph TD-4 running Citrix Systems' WinFrame (a Windows NT extension) and O'Reilly and Associates' WebSite. Finally there's a way to manage an NT system from afar.



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Mosaic - the "killer application" of the 90's, a point and click graphical interface that gives you access to the internet's vast pool of information.

Firewall security - a combination of security programs that control traffic in and out of your local network, preventing unauthorized access.

POP3 Mail Server & Eudora - delivers email between your desktop and the rest of the world through an intuitive, easy to use interface.

SLIP/PPP, ISDN, and T1 (optional) Interface - multiple possibilities for connecting the system to the internet; from low-cost SLIP/PPP dialup to a direct, high-speed T1 line.

WAIS - libraries of knowledge can be accessed through a powerful search utility.

TCP/IP - every machine on your network gets as much or as little internet capability as needed.

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Circle 90 on Inquiry Card.

New Media Is the Message

The latest breed of PowerPC-based Macs integrates sound, speech, video, telephony, conferencing, graphics—and an affordable price

RICK GREHAN

The new line of Power Macs exemplifies Apple's market pitch: easy-to-use, fully featured multimedia systems right out of the box. The latest triad—the Power Mac 7200, 7500, and 8500—come equipped with integrated audio, video, networking, telephony, CD-ROM, conferencing, and speech. As you go higher in the line, the bundled support gets richer.

Perhaps the best pitch of all is the pricing. These Power Macs, with their healthy collection of built-in features and prices ranging from \$1949 (for the 90-MHz 7200 with 8 MB of RAM) to \$4199 (for the 120-MHz 8500 with 16 MB of RAM), will compete well against even the most aggressively priced Intel-based machines.

Common Denominators

All three Power Macs in this group share a remarkable number of similar features. Even though some of the similarities are architectural (all have three Peripheral Component Interconnect [PCI] slots, for example), most of them fulfill multimedia and communications requirements.

All models include stereo-audio input and output ports. The digital side of the systems' audio-generation capabilities boasts 16 bits of resolution and a sampling rate up to 44.1 kHz (CD-quality sound). On the communications side, all models include 10Base-T and AAUI-15 Ethernet connectors. And all models include high-speed DMA serial ports, compatible with GeoPort telephony/fax hardware.

As usual, Apple paid close attention to the design of the boxes themselves. For example, the 7200's top is held on by hid-



The new Power Macs: the 7500 (left), the 8500 minitower (center), and the low-end 7200. All three models include impressive multimedia support. Apple's clever design (inset) grants easy access to memory slots and the motherboard.

den latch releases under the front bezel. Release those, and the top slides off to reveal the power supply, disk drives, and a hinged inner cover that holds the PCI cards in place. The memory slots are beneath the drive units—a position that at first appears impossible to get at without major disassembly. But the entire drive and power supply unit is also hinged, and it swings up to provide easy access to any corner of the motherboard.

Of course, hardware is only part of the story. If there's Windows software that you can't live without, all three models can run SoftWindows from Insignia Systems. Both the 7500 and 8500 models' impressive software bundles include PlainTalk (the combined text-to-speech and speech-recognition engine) and Apple Media Conference (a QuickTime application that

incorporates videoconferencing, whiteboard collaboration, and more).

We tested Media Conference by hooking a Power Mac 8500 to a 7500 across 10Base-T Ethernet (see the screen on page 114). The video was jerky but usable, and we could relay messages and freehand sketches on the shared whiteboard. Unfortunately, application sharing is not supported, and the audio quality was poor.

Power Mac 7200

The low-end model of the series, the Power Mac 7200, houses a 75- or 90-MHz PowerPC 601 processor. Memory starts at 8 MB, but you can expand that to 256 MB. Similarly, a baseline 7200 houses only a 500-MB SCSI drive, but an internal expansion bay supports another SCSI device (and, remember, there's always the rear SCSI connector for external drives).

The 7200's graphics system is built

THE SPECS

	7200	7500	8500
CPU	601	601 or 604	604
MHz	75 or 90	100	120
Internal cache (KB)	32	32	32
External cache	256 to 512 KB	256 KB to 1 MB	256 KB
System memory (MB)	8 to 256	16 to 512	16 to 512
Video memory (MB)	1 to 4	2 to 4	2 to 4
Hard disk	500 MB	500 MB to 1 GB	1 to 2 GB

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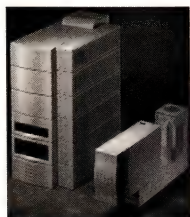
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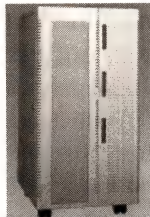
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A Look at the Big Picture

JANUARY 1996
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MONITORS

BEST

POWER MODULE

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DEGAUSSING COIL

Wraps around the picture tube. The Earth's magnetic pull and movement of the active display cause the picture tube to magnetize, resulting in image distortion. By pressing the degauss button, the degaussing coil demagnetizes the picture tube.

VIDEO BOARD

Residing at the rear of the CRT, it controls, amplifies, and processes the video-signal input from the system's video card.

FLYBACK TRANSFORMER (FBT)

The power source to transfer the electrons from the back of the monitor to the screen in the front.

HORIZONTAL SCANNING CIRCUITRY

Browns the electron beam horizontally on the screen (measured in kHz). The monitors with higher horizontal scanning frequency provides less flicker on the screen.

YOKE

The coil around the CRT drives the electron beam to a specific pixel on the screen.

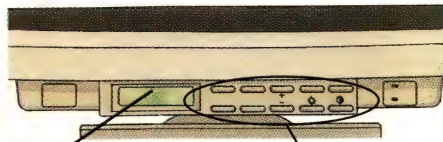
SCREEN SURFACE

The flat screen is treated with antistatic coating. The antistatic coating reduces the electric charge on the screen, and the antiglare coating reduces the reflection on the monitor. Also look for ergocoated and ergopaneled screens. These special coatings provide sharp images and reduce eyestrain.



BNC/D-SUB CONNECTORS

Look for monitors with both BNC and D-sub connectors. At high scanning frequencies, we preferred BNC connectors over the D-sub because the connectors provide additional shielding between the video input and the signal lines.



LCD

Displays the status of the monitor operations, selected main and subcontrols (to adjust the display), resolutions, scanning frequencies, and so on. The monitors with an LCD don't come with the on-screen menus to adjust the display.

CONTROLS

The functions of the control buttons should be labeled clearly. We preferred on-screen controls with a minimum set of buttons over the old-fashioned two buttons/control or thumbwheel control.

BEST OVERALL MONITOR

NEC Multisync XE21

This Plug and Play-compatible monitor is a breeze to set up and has outstanding on-screen menu controls. The documentation is excellent, but we never had to refer to it. The NEC Multisync XE21's superior internal power management made it a high scorer in the power tests.

PAGE 121

BEST HIGH-QUALITY MONITOR

Apple Multiple Scan 20-inch

This monitor's 19.1-inch display offers the highest quality in our image-sharpness, image-quality, and distortion tests. The 75-Hz vertical refresh rate displays an absolutely flicker-free still image. Its usability is average because it doesn't have on-screen menu controls.

PAGE 121

BEST LOW-COST MONITOR

NEC Multisync XE21

Due to its superb overall performance and a \$1899 price tag, the NEC Multisync XE21 wins this category. The unit stands out for its maximum resolution of 1280 by 1024 pixels in noninterlaced mode, usability features, and internal power management functions.

PAGE 121

(\$1780). In this roundup, the average price is \$2255. (In our last report, the average price was \$2243.)

You'll need a strong back to lift these behemoths and a large work area; the average weight is 74 pounds, and they take up voluminous desk space. The Philips Magnavox CM2137 consumed the least power at 110 W, and the NEC Multisync XP21 the highest at 197 W. Fortunately, all the monitors we tested, except for the Daytek DT-2102M, are Energy Star-compliant, so they consume less than 30 W in idle mode; and with VESA Display Power Management Signaling (DPMS) compliance, the internal power management system kicks in (consuming less than 30 W of power) when the monitor is idle. If the monitor is in idle mode for a long

time, the VESA DPMS will put the unit in sleep mode, consuming less than 8 W of power.

The IBM P201, Nanao Flexscan FX2-21, Nokia Multigraph 445X, and the Philips Magnavox CM21BA cost more than the rest of the products tested here for a reason; they have higher bandwidths (up to 250 MHz) compared to low-priced products at around 130 MHz and thus provide higher vertical refresh rates (close to 85 Hz) at higher (1600- by 1200-pixel) resolutions. Because we tested all the monitors in 1280- by 1024-pixel resolution, we did not evaluate these four monitors at these high refresh rates. We consider them to be in a class of their own, offering a higher usable resolution that is worth the price for those who need it.

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M1566



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Designed for
Microsoft
Windows95

	LTE 5000	LTE 5000	LTE 5000	LTE 5100	LTE 5100	LTE 5200
CPU	75MHz Pentium®	75MHz Pentium®	75MHz Pentium®	90MHz Pentium®	90MHz Pentium®	120MHz Pentium®
L2 cache	256KB, 64-bit	256KB, 64-bit	256KB, 64-bit	256KB, 64-bit	256KB, 64-bit	256KB, 64-bit
Video	32-bit PCI local bus	32-bit PCI local bus	32-bit PCI local bus	32-bit PCI local bus	32-bit PCI local bus	32-bit PCI local bus
Display	10.4 dual-scan color	11.3 dual-scan color	10.4 active-matrix color	10.4 active-matrix color	10.4 active-matrix color	10.4 active-matrix color
Resolution	640 x 480	800 x 600	640 x 480	800 x 600	800 x 600	800 x 600
RAM	8MB std., 72MB max.	8MB std., 72MB max.	8MB std., 72MB max.	8MB std., 72MB max.	8MB std., 72MB max.	8MB std., 72MB max.
Hard drive	510MB	810MB	810MB	810MB	810MB	1.35GB
CD-ROM	optional	optional	optional	optional	double-speed	optional
PC Card	2 type II or 1 type III	2 type II or 1 type III	2 type II or 1 type III	2 type II or 1 type III	2 type II or 1 type III	2 type II or 1 type III
Battery	NiMH	NiMH	NiMH	NiMH	NiMH	Lithium Ion
Weight	7.1 lbs.	7.5 lbs.	7.3 lbs.	7.4 lbs.	7.7 lbs.	7.0 lbs.
	\$3841.00	\$4514.00	\$4802.00	\$5378.00	\$5849.00	\$6435.00
	CDW 60595	CDW 60596	CDW 60597	CDW 60598	CDW 60599	CDW 60600

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4000C 75MHz 720MB hard drive, 10.1" active-matrix color display	\$3999.00	CDW 55174
4050C 90MHz 720MB hard drive, 10.1" active matrix color display, 2X CD-ROM	\$4649.00	CDW 55176
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Pre-loaded Windows 95



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420CX, 420MB hard drive, 10.4" active-matrix color display	\$3073.00	CDW 56256
430C, 720MB hard drive, 10.4" dual-scan color display	\$2881.00	CDW 56257
430CX, 720MB hard drive, 10.4" active-matrix color display	\$3553.00	CDW 56259



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IntelDX2™, 50MHz, 10.4" active matrix color display



701C 360MB hard drive	\$2199.00	CDW 51788
IntelDX4™, 75MHz, 10.4" dual scan color display		
701CS 360MB hard drive	\$2669.93	CDW 51794
701CS 540MB hard drive	\$2949.89	CDW 51795
701C 360MB hard drive	\$3199.96	CDW 51792
701C 540MB hard drive	\$3488.63	CDW 51793

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760C 90MHz, 10.4" active-matrix, 720MB hard drive	\$5349.00	CDW 59019
760C 90MHz, 12.1" active-matrix, 720MB hard drive	\$6049.00	CDW 59018
760C 120MHz, 12.1" active-matrix, 720MB hard drive	\$6599.00	CDW 60134
760CD 90MHz, 12.1" active-matrix, 1.2GB hard drive, 4X CD-ROM	\$7449.00	CDW 59017



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Byte 1/96

under \$2000 and have the same physical appearance, with similar control buttons and software used in the pop-up screen menu. These monitors perform similarly because they both use the Matsushita picture tube. During our series of tests, we noticed

that both monitors squeak when switching from text to graphics, with a lot of delay. The Panasonic C-2192P's quality performance is close to the top score, and it received an outstanding score in distortion tests.

NEC's XP21

rated the highest in the image-quality tests. The XP21 costs \$400 more than the XE21, but it provides a higher 1600- by 1200-pixel resolution, higher horizontal and vertical scanning frequencies, and more factory presets and user-settable display modes. This is the only monitor that comes with the Access.bus connector. The Access.bus supports bidirectional communications for future enhancements

(see the text box "Access.bus Technology" on page 125).

The Mitsubishi Diamond Pro 21TX scored the highest in our features rating, providing a high resolution of 1600 by 1200 pixels, extended warranties, on-site service, and BBS support service. It also has such high-end control features as focus, signal level, and digital control. Most other monitors lacked some of these features. Although the Diamond Pro 21TX was our high scorer in this area, it is not an FCC Class B residential monitor, lacks unlimited technical support, and has a high dot pitch.

KEY

Ratings from 1 to 4: ▲ is the lowest; ▲▲▲▲ is the highest.

BYTE BEST

HIGH-QUALITY MONITORS

For superior quality and control...

BEST OVERALL

NEC Multisync XE21



The NEC Multisync XE21 uses an opticlear screen and an NEC picture tube. It has excellent on-screen menu controls that let you adjust the display at the touch of a button. A Plug and Play monitor, it comes with outstanding documentation; toll-free and on-line support services offer excellent technical support to end users. It received a high score in NSTL's power management tests. For \$100 more, our third choice, the Panasonic C-2192P, offers 1600- by 1280-pixel resolution with a higher quality worth the price.



		PRICE	OVERALL SCORE	QUALITY INDEX	FEATURES SCORE	VARIABLE SIZE (INCHES)	DOT PITCH (MM)	MAXIMUM RESOLUTION NONINTERLACED	MAC 16-INCH SUPPORT OR HIGHER	ON-SCREEN MENUS
BEST	NEC Multisync XE21	\$1899	8.6	▲▲▲	▲▲▲	19.8	0.28	1280x1024	✓	✓
RUNNER-UP	Viewsonic 21PS	\$1995	8.2	▲▲▲	▲▲▲	19.7	0.25	1600x1280		✓
RUNNER-UP	Panasonic C-2192P	\$1999	8.1	▲▲▲▲	▲▲▲	19.7	0.25	1600x1280		✓
RUNNER-UP	NEC Multisync XP21	\$2299	8.1	▲▲▲▲	▲▲▲	19.8	0.28	1600x1200	✓	✓

Excellent quality and services

HIGH-QUALITY

Apple Multiple Scan 20-inch



The Apple Multiple Scan 20-inch is the only monitor that featured a bonded panel screen and a Trinitron picture tube, providing superior performance. This 66-pound FCC Class A monitor comes with optional TCO-compliant support. You get a one-year warranty with unlimited toll-free technical support, a BBS, and on-line support services. It does not support on-screen menu controls to adjust the display. Our second choice in this category, the Panasonic C-2192P, costs \$150 less than our winner. With 0.25-mm dot pitch (one of the lowest in this series of monitors), it provides a high-quality display at a resolution of 1600 by 1280 pixels. Its quality score is very close to the winner, and its overall performance is slightly higher in this category.

		PRICE	OVERALL SCORE	QUALITY INDEX	FEATURES SCORE	VARIABLE SIZE (INCHES)	DOT PITCH (MM)	MAXIMUM RESOLUTION NONINTERLACED	MAC 16-INCH SUPPORT OR HIGHER	ON-SCREEN MENUS
BEST	Apple Multiple Scan 20-inch	\$2149	8.0	▲▲▲▲	▲▲	19.1	0.26	1280x1024	✓	
RUNNER-UP	Panasonic C-2192P	\$1999	8.1	▲▲▲▲	▲▲▲	19.7	0.25	1600x1280		✓
RUNNER-UP	Philips Magnavox CM21BA	\$2799	7.8	▲▲▲▲	▲▲▲▲	20.1	0.26	1600x1280	✓	✓
RUNNER-UP	Radius Multiview 21	\$2149	8.0	▲▲▲▲	▲▲	19.0	0.25	1600x1200	✓	✓

Impressive quality, usability, and price

LOW-COST

NEC Multisync XE21



At \$1899, the NEC Multisync XE21's 19.8-inch display delivers a maximum resolution of 1280 by 1024 pixels, a superior set of support features, and impressive usability. Our second choice in this category, the Tatung CM-20MKR, provides 1600- by 1200-pixel resolution and costs \$100 less than our winner. However, its overall performance is significantly lower than that of the XE21. The Tatung CM-20MKR monitor had lower performance in our legibility, resolution, convergence, and contrast-ratio tests. However, with 0.28-mm dot pitch, its quality performance was slightly better than that of the XE21.

		PRICE	OVERALL SCORE	QUALITY INDEX	FEATURES SCORE	VARIABLE SIZE (INCHES)	DOT PITCH (MM)	MAXIMUM RESOLUTION NONINTERLACED	MAC 16-INCH SUPPORT OR HIGHER	ON-SCREEN MENUS
BEST	NEC Multisync XE21	\$1899	8.6	▲▲▲	▲▲▲	19.8	0.28	1280x1024	✓	✓
RUNNER-UP	Tatung CM-20MKR	\$1799	7.4	▲▲▲	▲▲	19.0	0.28	1600x1280	✓	
RUNNER-UP	Smile CA2111	\$1780	7.2	▲▲▲	▲▲	19.75	0.28	1600x1280	✓	
RUNNER-UP	Daytek DT-2102M	\$1899	6.9	▲▲▲	▲	19.5	0.28	1600x1280	✓	

✓ = Yes

ACCESS.BUS TECHNOLOGY

The Access.bus is a bidirectional-communications industry-standard bus for peripheral connectivity. Peripherals that support the Access.bus provide a connector or port connection that is similar to a phone-jack connector. It can connect peripherals such as monitors, printers, modems, mice, keyboards, scanners, and digitizers to the system.

The advantage of the Access.bus is hassle-free installation. You can connect an Access.bus device (e.g., a monitor) to your system, and the system automatically identifies and configures it for optimum performance. The system and the attached device automatically configure themselves by communicating via the Access.bus, thus eliminating the memory-hogging platform-specific driver installation, DIP switches, jumpers, or terminators.

The Access.bus connection protocol was developed by Digital Equipment and Philips Semiconductors in 1985. Because of its simplicity, it is widely accepted as an industry standard. Many hardware peripheral vendors plan to provide this connection

in future products. This connectivity can be provided on existing peripherals and software-controlled devices. NEC Technologies has a head start in this game by offering an Access.bus connector on its XP series of 17- and 21-inch monitors.

With the Access.bus connection, you can connect up to 125 devices to your system in daisy-chain fashion, without having to manually configure each device. For example, you can connect your system to the monitor via the Access.bus, connect the printer to your monitor, connect your modem to the printer, and so on. The order in which you connect is irrelevant. If you want to add another device into the chain, it can be plugged in anywhere, and the system will know what I/O to use to address that device.

The system communicates with each of the connected devices via the Access.bus, and each device is intelligent enough to respond to the system calls. Because the device communicates via the Access.bus, the platform on which it is connected be-



NEC's Multisync XE21 features an Access.bus connection (shown above) for hassle-free installation.

comes irrelevant. The Access.bus can also be used to update the flash ROM on the peripheral.

Windows 95 provides a Plug and Play device featuring an automatic detection of the monitor. Here, the monitor identifies itself as a Plug and Play-compatible device easing the setup and configuration time. With Access.bus compatibility, peripheral manufacturers should make their products more intelligent to accept and send instructions back and forth to the system.

HONORABLE MENTIONS

Radius's Multiview 21, MGC Technologies' MGC 2182, Panasonic's C-2192P, and Viewsonic's 21PS

(from left to right) feature the same control buttons and menu software. These four monitors use the same Matsushita picture tube with 0.25-mm dot pitch and dotted mask type. Despite these similarities, the Panasonic monitor offered the highest quality among them, and the MGC the least. The quality of the Multiview 21 and the Viewsonic 21PS was similar.



On-Screen Menus

Of the 20 monitors we tested, 14 had display controls in an on-screen menu. Monitors supporting on-screen menus have the least number of buttons and lights. The buttons on the monitor display the pop-up menu, select the controls in the menus, and

increase or decrease the selected control. Some of the monitors automatically remove the menu from the screen if the menu is idle for a given period of time. This can be annoying when you haven't finished with the adjustment. Testers preferred that the menu stay on until the testers wanted to exit.

Dubious Achievement

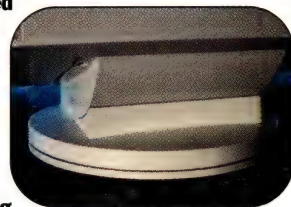
Congested BNC Connectors

We tested the monitors using BNC connectors, if provided. A BNC cable connector has five connectors, one each for RGB (a total of three), H-sync, and V-sync signals. Some monitors place the five connectors in one row, with equal spacing in between the connectors. This is the preferred, easy-to-use placement. Other manufacturers, such as Nokia, position the connectors in two rows, with RGB in the first row and the H- and V-sync connectors in the second row. This arrangement is inconvenient, because there is not enough room between the rows to grasp and twist the connectors.



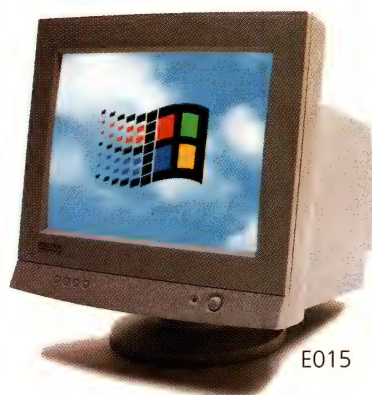
Circular vs. Rectangular

Of the 20 monitors we tested, half of them used circular bases as opposed to the rectangular type. Based on our subjective usability testing, technicians expressed a preference for those with circular bases, citing them as easier to move, tilt, and swivel.





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NEC TECHNOLOGIES, INC. MULTISYNC XP21	NOKIA DISPLAY PRODUCTS, INC. MULTIGRAPH 445X	NSA SUPERSCAN PRO 21	NSA SUPERSCAN ELITE 21	PANASONIC COMMUNICATIONS AND SYSTEMS CO. C-2192P	PHILIPS CONSUMER ELECTRONICS CO. MAGNAVOX CM2137	PHILIPS CONSUMER ELECTRONICS CO. MAGNAVOX CM21BA	RADIUS, INC. MULTIVIEW 21	SMILE INTERNATIONAL, INC. CA2111	TATUNG CO. OF AMERICA, INC. CM-20MKR	VIEWSONIC 21PS
\$2299 3	\$2575 3	\$1995 3	\$2195 3	\$1999 3	\$2499 3	\$2799 3	\$2149 1	\$1780 3	\$1799 2	\$1995 3
8.1	7.7	7.5	7.5	8.1	7.9	7.8	8.0	7.2	7.4	8.2
8.6	8.5	8.5	8.4	9.0	8.1	8.8	8.6	7.8	8.5	8.5
9.1	6.5	6.6	7.0	7.6	6.4	5.6	8.7	6.6	6.0	7.9
3.6	4.3	4.7	4.7	6.7	6.2	4.8	4.9	5.9	5.6	4.8
8.0	8.5	7.1	7.1	7.8	8.9	8.7	6.9	6.9	6.7	8.5
AG, AS, AR, O	AG, AS	AG, AS, AR	AG, AS, AR	AG, AS, AR	NG, AG, AS, AR	NG, AG, AS, AR	AS, AG	AG, AS	AG, AS	NG, AG, AS, AR
0.28 Invar ShadowMask NEC	0.26 Invar ShadowMask Matsushita	0.26 Dotted Hitachi	0.26 Dotted Hitachi	0.25 Dotted Matsushita	0.28 Dotted Hitachi	0.26 Dotted Hitachi	0.25 Dotted Matsushita	0.28 Dotted Hitachi	0.28 Invar ShadowMask Hitachi	0.25 Dotted Matsushita
1600 1200	1600 1280	1600 1280	1600 1280	1600 1280	1600 1200	1600 1280	1600 1200	1600 1280	1600 1280	1600 1280
<0.3 <0.5	0.3 0.4	0.3 0.4	0.3 0.4	0.4 0.45	<0.3 <0.4	<0.25 <0.35	<0.3 <0.5	<0.3 <0.4	1 6	0.3 0.4
31 89 55 160	30 102 50 120	31 85 50 160	31 95 50 160	30 82 50 160	30 94 50 160	30 107 50 170	31 85.3 50 120	30 82 50 100	28 82 50 120	30 85 50 160
● ● 85	● ● 200	● ○ 200	● ○ 200	● ● 135	● ● 157	● ● 250	● ● 130	● ● 130	● ● 130	● ● 135
21 42	28 14	5 26	6 25	3 13	16 14	12 16	9 9	36 36	9 15	8 13
75 75 76 75 75 76 70	60 75 100 76 75 75 80	160 130 130 N/A 85 75 63	160 150 150 N/A 95 85 70	60 N/A 75 70 75 75 62	60 75 56, 60, 72, 75 N/A 75 60, 75, 76, 84 60	60 75 75 N/A 75 75 75, 76, 80	67, 75 75 Auto 74, 75 75 75 69	100 75 56 to 90 87 75 75 66	60 75 56, 60, 72, 75 87 75 60, 70 60	Up to 160 Up to 130 Up to 135 Up to 80 Up to 90 Up to 80 Up to 69
● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ○	● ● ● ○	● ● ● ●
● ● A	● ● B	● ● B	● ● B	● ● B	● ● B	● ● A	● ● B	● ● B	● ● A	● ● B
78.8 20.4 20.2 22.5	70 20.3 20.2 19.7	73 18.6 19.2 21	73 18.6 19.2 21	61.6 18.8 19.9 20.1	77 19.5 20.5 21	81 19.7 20.1 21	62 18.6 19.8 20	64 18.9 19.2 20.8	63 18 19 21	62.8 18.8 19.9 20.1
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Sumo Graphics Giants Weigh In

Two massive software bundles from Corel and Micrografx go belly-to-belly for the Windows 95 graphics-suite crown

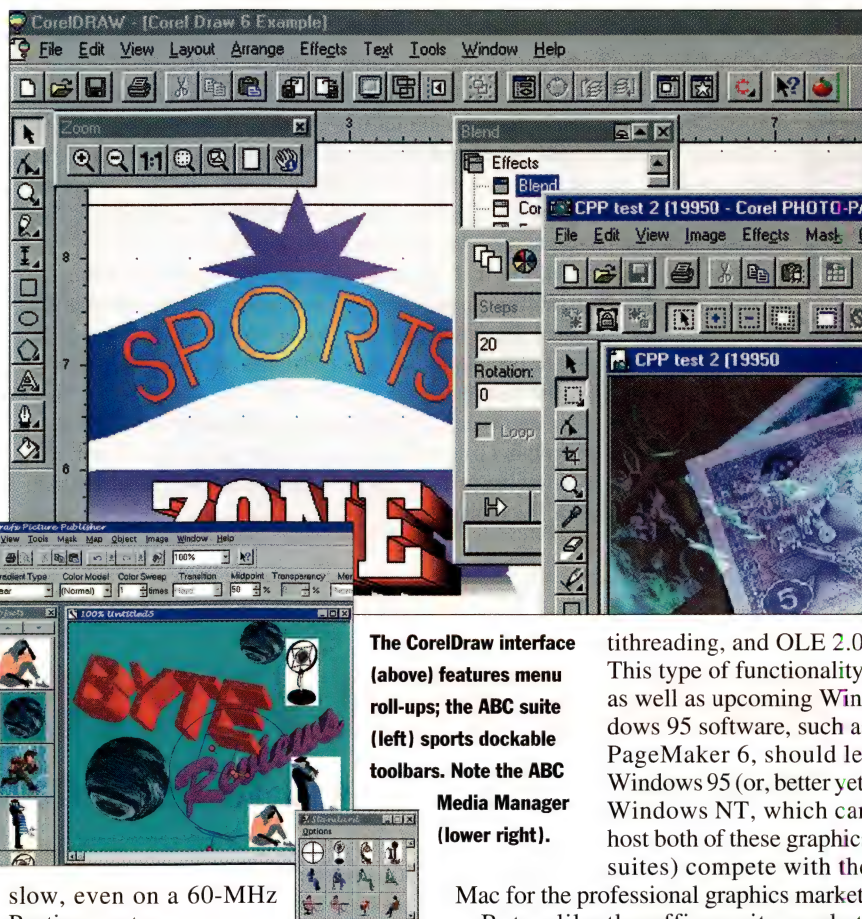
**STANFORD DIEHL AND
G. ARMOUR VAN HORN**

On the heels of the office-suite successes (and Microsoft's apparent TKO), graphics heavyweights Corel and Micrografx now battle for the Windows 95 graphics market. Both companies tout the obvious advantages of buying a graphics suite from one vendor: a comprehensive one-buy solution, smooth integration across modules, one-stop support, and a discounted overall price.

But we think the two products will attract different markets. While CorelDraw 6 will appeal to current Corel shops and other graphics professionals, the Micrografx ABC Graphics Suite targets the general businessperson's graphics-production needs by skillfully wrapping the company's most popular graphics applications in a Microsoft Office-compatible interface.

Big, Fat Graphics

Also in the spirit of the office suites, these bundles are huge and ungainly. The basic installation of CorelDraw 6 takes a whopping 180 MB. The ABC Graphics Suite fills about 85 MB. You can run CorelDraw from a CD-ROM, but it still requires up to 32 MB of hard disk space. When we ran the Corel applications from a double-speed CD-ROM, performance was unacceptably



The CorelDraw interface (above) features menu roll-ups; the ABC suite (left) sports dockable toolbars. Note the ABC Media Manager (lower right).

slow, even on a 60-MHz Pentium system.

We also had problems installing from some CD-ROM drives. Information on Corel's World Wide Web site blamed real-mode CD-ROM drivers. Older systems might also experience problems with scanners, drawing tablets, video cards, and other hardware not specifically supported by Windows 95 drivers. The stability of drawing-tablet drivers was so poor at the release of Windows 95 that Micrografx chose not to support any pressure-sensitive tablets with this version, even though earlier versions supported them.

For all practical purposes, these suites need Pentium systems with 16 MB of RAM and a 1-GB or larger hard drive. It's time to bite the Windows 95 resource bullet.

If you've got the hardware, though, these suites are significantly improved for Windows 95, with judicious right-click menus, drag-and-drop support, long filenames, mul-

tithreading, and OLE 2.0. This type of functionality, as well as upcoming Windows 95 software, such as PageMaker 6, should let Windows 95 (or, better yet, Windows NT, which can host both of these graphics suites) compete with the

Mac for the professional graphics market.

But unlike the office-suite market, graphics shops have not embraced the single-bundle philosophy. The graphics market has responded well to specialized niche products from Adobe, Macromedia, and Quark. Nor does this market show any signs of becoming Windows-only. Adobe Illustrator, PageMaker, Photoshop, and Macromedia FreeHand are clearly committed to both Windows and Mac platforms. Corel and Micrografx remain specific to Windows.

The Reigning Sumo Champ

Corel has removed Ventura Publisher from the CorelDraw package but, as usual, has added lots of new stuff. The problem for Corel has always been integrating new modules into a consistent whole. The company has made strides in this area, especially with PhotoPaint, but the overall suite still feels somewhat cobbled together.

continued

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Fax-on-demand delivers Touch-Tone access to timely news and data. Long-term, it can save labor and marketing costs.

DAVID ESSEX AND STEVEN J. VAUGHAN-NICHOLS

"I'll fax it right over," you say, and thus begins a solid 20 minutes of wasted time: Find the document, stand in the fax line, dial the wrong fax number, find the right one, stand in the line again, send the fax, go back to your desk, and take the inevitable call: "Could you fax that again? Our machine ate the last page."

There is a better way. It's called fax on demand (FOD), and it applies to a number of new products that enable callers to request faxes directly from your fax server. No matter what your business, if you get a lot of calls requesting printed information, you should consider FOD.

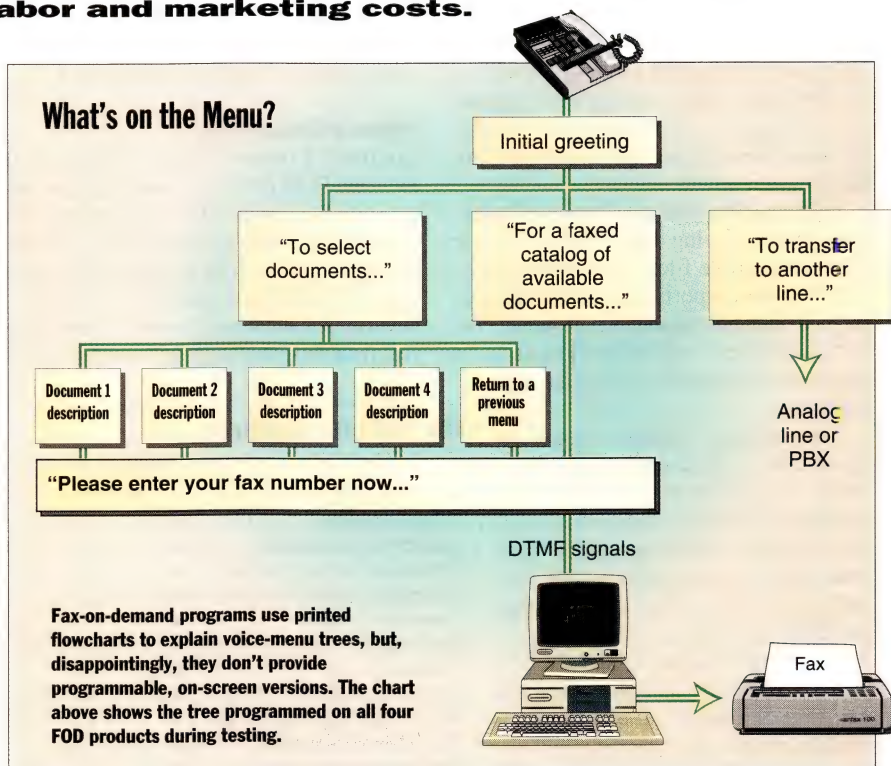
FOD systems deliver documents stored in a dedicated repository (and, occasionally, corporate data that isn't normally stored in faxable formats, such as PCX and TIFF). Callers can dial in from their fax machine's handset and get documents returned during the same call, saving phone costs for the sender. More typically, they choose documents and enter the fax number using a Touch-Tone phone. The FOD system then transmits the requested documents on a separate line.

FOD systems for in-house use are often sold in turnkey form, with preconfigured voice and fax boards already installed in a computer. You can also put one together using Visual Basic-like development toolkits. We looked at DOS-/Windows-based software that is also available in kit form (i.e., the software vendor also sells voice and fax boards).

FOD Facts

Conceptually, FOD systems are simple. The voice board receives DTMF tones generated by the caller's handset and passes them to the FOD software, which reads and plays back the appropriate voice messages stored on the PC's hard drive. (None of the reviewed programs accepts pulses from rotary dialers.) When the caller identifies a specific document, the FOD software loads it and sends it to the fax board for transmission. The fax board then transmits the document to the phone number specified by the caller.

To put the four FOD systems we tested



on equal footing, we ran all our tests on an IBM PS/1 57C, a 33-/66-MHz 486DX2 system with 700 MB of disk space and 16 MB of RAM. The machine was equipped with a one-line Dialogic D/41D voice card and a one-line GammaLink GammaFax CPI/100 fax card (Ibex Technologies' Facts-Line required a second Dialogic board). Two outgoing fax lines is a more typical setup, but little is gained by testing the second line, since the relevant queuing issues exist on a one-line system.

To flood the system with requests, we made three calls in rapid succession, requesting two one-page documents during each call. We measured fax-throughput times for each pair of document transmissions and then averaged the results. We sent all faxes to the same machine, a Ricoh RF 860. VP Express was slightly faster than the other programs at transmitting faxes held in a queue, but the difference in performance among these solutions was negligible.

All four programs have some features in common. For starters, each is best run on a dedicated machine. Even in these days of gigabyte-capacity drives, disk-space requirements alone make putting FOD soft-

ware on a user's PC unrealistic. Also, FOD software doesn't get along well with other programs. Almost all these programs specifically discourage the use of memory management software, and with good reason: They don't work well—if at all—with a memory manager loaded.

None of these programs is easy to install. Be ready to spend at least two days shaking out all the software conflicts and putting together a decent voice-menu tree. Once our installation wars were over with, though, each program performed well. All worked with the basic file formats typically used in faxing—PCX, TIFF, and ASCII—without any trouble. Each also proved reliable in the face of disconnections and other failures.

Copia International's FaxFacts

All these programs were troublesome to install, but Copia International's FaxFacts 5.0, which requires you to make directories in DOS and manually invoke the installation routine for each program disk, took the installation-complexity prize. Once in place, however, this MS-DOS program worked well.

continued

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3-D Without RISC

Intergraph's TDZ-400 puts two Pentium Pros to work speeding 3-D graphics

DAVE ROWELL

In 1994, Intergraph gambled that it could abandon RISC for multiprocessor Intel boxes and still get 3-D workstation performance. Now comes the payoff with the Pentium Pro. Intel's new chip delivers RISC-level performance and x86 compatibility, too.

The 150-MHz Pentium Pro is fast; our BYTEmark CPU test (32-bit code) shows its integer performance is 2.1 times that of a 90-MHz Pentium, and its floating-point performance is 2.6 times faster. The 200-MHz Pentium Pro, announced after

we completed these tests, should be as fast—or faster than—any RISC chip except Digital Equipment's 21164 Alpha. Intergraph plans to ship a 200-MHz version of its TDZ workstation before 1996, with prices \$2500 higher per CPU than the 150-MHz models.

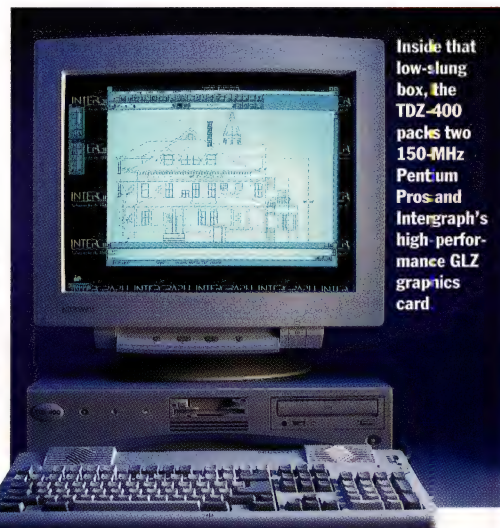
We tested the first Pentium Pro system, a \$24,195 Intergraph TDZ-400 with two 150-MHz Pentium Pro CPUs, 64 MB of RAM, a 2-GB SCSI hard drive, and a 21-inch monitor. The systems come with Windows NT 3.51, a PCI-bus GLZ graphics card, built-in Ethernet, PC Card slots, a quad-speed CD-ROM drive, and a keyboard with microphone and stereo speakers. The TDZ-300 has a single Pentium Pro, the TDZ-400 has two, and the desktide TDZ-600 has four. The new models carry slightly higher prices than the old Pentium line (around \$1000 more for comparable TDZ configurations with 150-MHz Pentium Pros).

Our test configuration used Intergraph's newest 3-D card, the GLZ1T—a GLZ1 accelerator with an added texture-processing board. In addition to 12 MB of video RAM (for double-buffered, 1152-by-864-pixel graphics with 24-bit z-buffering), the card has 8 MB of memory for storing texture maps. It has the same \$8000 price as the 24-MB GLZ2 we tested in the TDZ-40 (see "3-D Graphics Go Zoom," September BYTE). All GLZ cards support the OpenGL 3-D API under NT.

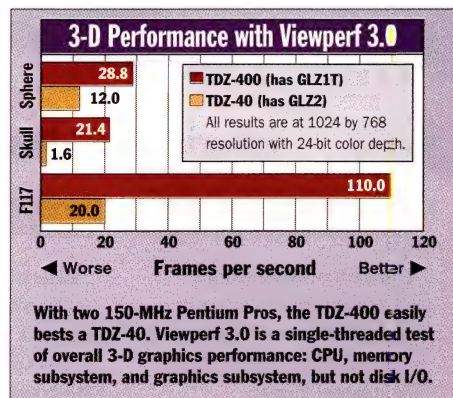
Exceeds Expectations

We were surprised by just how much the Pentium Pro boosted the TDZ-400's 3-D graphics performance. The TDZ-400 ran the OpenGL Performance Characterization Committee's Viewperf 3.0 test 2.5 to 13 times faster than the TDZ-40 with two 100-MHz Pentiums and ran the rendering tests with Bentley Systems' MicroStation three to four times faster (not shown).

Based on the BYTEmark tests, the floating-point speed difference between a 100-MHz Pentium and a 150-MHz Pentium Pro is 134 percent (2.3 times), while the GLZ1T's texture processing provides only a 15 percent boost (based on Intergraph's tests). Intergraph attributes the gain to the Pentium Pro's floating-point speed, bet-



ter memory architecture (i.e., interleaving, an integrated L2 cache, and a more efficient CPU bus), and improved OpenGL drivers for its GLZ cards. Intergraph's Mogile, a multithreading OpenGL driver for the MicroStation, provided a 5 percent to 50 percent performance boost by putting both processors into play.



Intergraph cast its lot with promising standards: x86 compatibility, PCI, Windows NT, and OpenGL. For 3-D visual computing applications like mechanical CAD, it's a winning combination. ■

Dave Rowell is a BYTE technical editor. You can contact him on the Internet or BIX at drowell@bix.com.

Product Information

TDZ-400 \$24,195
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Huntsville, AL
(800) 763-0242
(205) 730-5441
<http://www.intergraph.com>
Circle 1139 on Inquiry Card.

Texture Details

Texture mapping adds realism to 3-D displays by draping 2-D patterns, such as wood grain or a Landsat image, over 3-D surfaces. Ideally, it adjusts the patterns for perspective and surface shading. More capable workstations keep texture maps readily available in dedicated memory within the graphics subsystem. Texture mapping can then move quickly into a rendered image without bogging down the host system. Several of Intergraph's GLZ graphics cards, for example, store 8 or 32 MB of texture data and pipe it to the image midway through the rendering process via a 64-bit, 256-Mbps graphics bus.

Though fast, dedicated texture memory is costly and limits image size for some applications. Storing texture data in system memory extends texture storage. Using OpenGL texture-object extensions, Intergraph's texture-processing hardware can store large texture maps in system memory and use the dedicated texture memory as a cache, moving data between the two areas over the relatively fast Peripheral Component Interconnect (PCI) bus.

Ultrafast UltraSparcs

With an innovative crossbar and multimedia architecture, the first 64-bit UltraSparc workstations thrust the spotlight back on Sun

BEN SMITH

Sun's highly anticipated 64-bit UltraSparc processor has arrived in two new high-performance workstations: the Ultra I Model 140 and Ultra I Creator3D Model 170E. The stakes are high for a company that has lost significant ground in the workstation market to sexy systems from Hewlett-Packard and Silicon Graphics, Inc. (SGI). But with the Ultra's innovative packet-switched crossbar and specialized Visual Instruction Set (VIS), Sun has a strong hand to play. Although its benchmark numbers are nowhere near those of a Digital Equipment Alpha running Microsoft NT, the 170E easily outperforms everything else that runs the Solaris OS on a single processor.

For this review, we tested the Ultra I Model 170E, the higher-end, 167-MHz system with 64 MB of RAM standard. The less elaborate Model 140 hosts a 143-MHz UltraSparc processor and includes a standard 32 MB of RAM (see the table "Sun Specifications" at right for a list of standard features for both models).

Both systems are enclosed in the same compact chassis, about the size of a deep-dish pizza box (16 by 17 by 4 inches), and both models support two RS-423/RS-232 connectors, a parallel port, a CD-ROM drive, and a 3½-inch floppy drive. Sun had not finalized pricing at press time, but the Model 170E will list for under \$30,000; the Model 140 will come in under \$20,000.

By the Numbers

According to our benchmark testing, the 167-MHz Ultra 170E performs at roughly

1.8 times the speed of a 90-MHz Pentium. But because the BYTEmark test suite does not take advantage of the UltraSparc's specialized instruction set, the benchmark results do not tell the whole story. And you really need a shared-memory multiprocessor system to fully appreciate the new UltraSparc Port Architecture (UPA), a distributed-arbitration multimaster crossbar (see the Technology Focus box for details).

When we ran real-world applications—applying special-effect filters to large graphics images, rendering complex texture maps, and displaying high-motion MPEG video clips—the performance advantages of the UltraSparc architecture became obvious. The 64-bit VIS versions of these kinds of graphics and video applications will realize another order-of-magnitude boost in performance. Even without software recompilation, the Ultra I delivers an extremely fast platform for graphics applications.

UltraGraphics

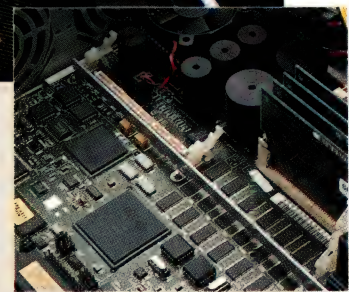
The UltraSparc processor includes a set of dedicated single-cycle instructions to enhance performance. VIS dramatically cuts the number of clock cycles required for graphical and video operations.

For example, VIS includes an array operation for slicing 3-D volumetric data. This operation, accomplished with a single UltraSparc instruction, typically requires 24 instructions, according to Sun. Other specialized one-cycle instructions support such operations as conversion instructions for packing and expanding pixel data, arithmetic instructions for manipulating large graphics images, and fixed-point compare instructions for examining the z-



DAVID SHOPPER © 1996

Sun's Ultra I Creator3D Model 170E (top) with its 64-bit UltraSparc (inset)



Sun Specifications

Model 140

143-MHz UltraSparc
32-MB RAM
1-GB hard drive
17-inch color monitor
10-Mbps Ethernet
10-Mbps SCSI
Three Sbus expansion slots
TurboGX graphics
Less than \$20,000

Model 170E

167-MHz UltraSparc
64-MB RAM
2-GB hard drive
20-inch color monitor
10- and 100-Mbps Ethernet
20-Mbps fast and wide SCSI
Two Sbus expansion slots
UltraSparc graphics
Less than \$30,000

FEATURES OF THE ULTRA I

- 64-bit address pointers
- Specialized Visual Instruction Set
- Branch prediction
- Four-way superscalar design with nine execution units
- 16-Kb data cache; 16-Kb instruction cache
- Integrated second-level cache controller
- 128 data lines to packet-switched crossbar
- 3.3-V operation

buffer during 3-D rendering.

The UltraSparc uses two sets of registers to process graphical commands: The integer registers crunch address calculations for the image data, while the floating-point registers handle manipulation of the image data. This division of labor deploys the maximum number of registers and augments instruction parallelism.

The UltraSparc also supports a wide range of video-compression algorithms, including H.261 (the standard compression algorithm for H.320 videoconferencing), MPEG-1 and MPEG-2, and JPEG. Again, the UltraSparc supports specific

Best Low-Cost Printer on the LAN

HP's new LaserJet 5Si MX will be the printer of choice for large workgroups

DAVE ROWELL

Network printers at the low end of the price range are getting faster. Case in point: Hewlett-Packard's new LaserJet 5Si MX. It's fast, and it comes with some great features for printing on the LAN. The 5Si MX's print-engine speed is 24 pages per minute (ppm). Its predecessor, the 4Si MX, has a 17-ppm engine. The 5Si MX holds 1100 sheets of paper, can handle 11- by 17-inch paper, and comes with bidirectional management software. This software supports real-time

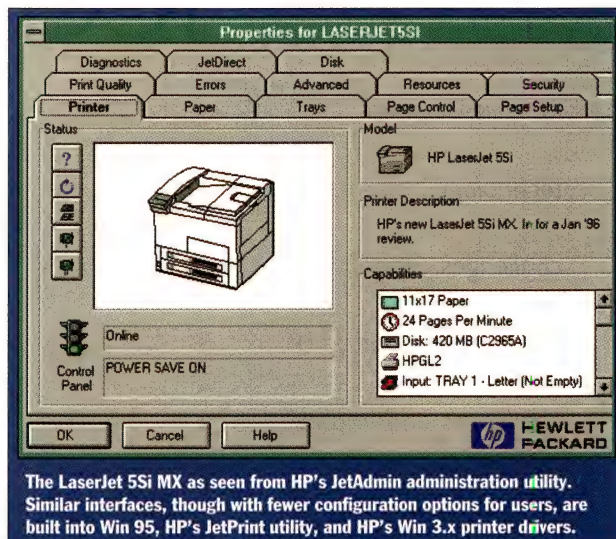
in features, usability, and speed. HP's new LaserJet is fastest in its price class. In fact, it's competitive with the more expensive 30- to 32-ppm printers, although its 100,000-page monthly duty cycle is still only half as high.

Options include a 2000-sheet input tray (\$1299), a mailbox with eight 100-sheet bins (\$1889) for separating print jobs, a duplexing unit (\$669), and an envelope feeder (\$549).

If you don't need a direct network connection and PostScript, you can consider the LaserJet 5Si (no MX) for \$3499. It lacks the MX's 350-KBps JetDirect Ethernet/Local Talk card and PostScript SIMM, and it has 4 MB of RAM instead of 12 MB.

Cool Software

HP has upgraded the JetAdmin software so that it now provides easy network configuration and management, including installing printer drivers for users over the network. With bidirectional printer communications, you can now track print jobs over the LAN in real time, getting such details as where the job is in the queue, how much of the job is complete, or where it will be output.



The LaserJet 5Si MX as seen from HP's JetAdmin administration utility. Similar interfaces, though with fewer configuration options for users, are built into Win 95, HP's JetPrint utility, and HP's Win 3.x printer drivers.

NEW AND IMPROVED

The LaserJet 5Si MX beats the 4Si MX in every way. We derived scores using NSTL test and evaluation methodology. Quality, features, and usability scores are scaled to a perfect 10.

	HP LASERJET 5Si MX	HP LASERJET 4Si MX
Price as tested	\$4899	\$5299
Pages per minute (PCL)	12.5	10.7
PPM (PostScript)	9.7	9.4
CPU speed (MHz)	40	25
Engine speed (ppm)	24	17
Quality score	8	7.9
Features score	7.8	7.1
Usability score	8.6	8.3

LaserJet 5Si MX \$4899
Hewlett-Packard Co.
Santa Clara, CA
(800) 752-0900
fax: (800) 333-1917
<http://www.hp.com>
Circle 1090 on Inquiry Card.

monitoring and control of the printer by administrators as well as users. All this for \$400 less than the 4Si MX.

We tested the LaserJet 5Si MX on a mixed NetWare 3.1 network with Macs and Windows-based PCs. We ran NSTL's network-printer benchmarks and compared the results to other recently tested network printers (see "12 Network Printers Set the Pace," November 1995 BYTE). Our testing revealed that although the new LaserJet didn't have the highest numbers in any one category, it consistently ran near the top in all categories (speed, print quality, features, and usability). As a result, the LaserJet 5Si MX produced an overall score higher than any printer in that group.

The 5Si MX has a slightly improved print-quality score over the 4Si MX (both are 600-dpi printers) but ranks considerably higher

Bidirectional drivers adjust to configuration changes automatically, so you always know what type of paper is in each of the 5Si's size- and capacity-sensing trays. With easy configuration, slick software interface, and neat new features like booklet printing and gray-scale watermarks, this printer is fun to use. If you're looking for a faster network printer that won't keep you from balancing that budget, check out the 5Si MX. It's the best in its class. ■

Susan Colwell and Dave Rowell are BYTE technical editors. You can reach them by sending E-mail to scolwell@bix.com and drowell@bix.com, respectively.

MIB Makes Life Easier for LAN Managers

The LaserJet 5Si MX is one of the first printers to support the standard SNMP management information base (MIB) for printers. To provide administrators with a consistent means of managing LAN printers, the Printer Working Group developed, and the Internet Engineering Task Force accepted, the standard MIB in mid-1995.

The standard MIB means that each printer will store status information and respond to SNMP requests in a consistent manner through its SNMP agent software. In the case of the LaserJet 5Si MX, the SNMP agent resides in the upgradable firmware of the printer's JetDirect network card. The agent software monitors network traffic directed at the printer, filters out SNMP commands, and returns or sets values stored in the printer MIB to monitor status or change printer configuration.

To provide better response (asynchronous) to SNMP and other management software, HP changed the LaserJet 5Si multifunction I/O port, creating a separate channel for printer management (a datagram service). As a result, you can still control the printer while it is receiving print data—canceling a print job before it finishes, for example.

—SUSAN COLWELL

Power Tools for Data Drilling

IQ/Objects and PowerPlay help you find information buried in complex databases. One is a better analyst, the other a better query/report tool.

DAVID S. LINTHICUM

When it comes to automated tools that deal with masses of data, different products take different approaches. Query/reporting packages help you create views from complex queries, pass them along to a DBMS, and take the results and format them for presentation. Analysis packages slice and dice data, perform what-if analyses, and "drill down" to get more detail. The buzzword that describes what they do is *on-line analytical processing* (OLAP). Many of these tools don't perform the initial queries. Instead, they operate on data tables provided by a separate query package. Although there is some overlap in functionality, the two types of tools complement each other. In many organizations, both will find homes as the eyes and ears of busy executives.

In this review, we look at one tool from each category: IQ/Objects, a query/reporting tool from IQ Software, and PowerPlay, a data-analysis package from Cognos. (Note that each vendor also makes a package in the other category: IQ's analysis tool, announced in November 1995, is IQ/Vision. Cognos's query tool is Impromptu.) Both packages reviewed here provide connections to popular relational database servers, produce a wide variety of reports and graphs, and run under Windows 3.1 and Windows 95. Because of their different purposes, however, that's where the similarities end.

IQ/Objects

With its many features, IQ/Objects (IQ/O) is a good general-purpose reporting tool for Windows. It comes with a Report Designer, a run-time Report Viewer, and a Knowledge Base Editor for creating logical database views.

The reporting capabilities are impressive. IQ/O supports single- and multiple-column layouts, with vertical and horizontal data depiction. You can embed OLE 2.0 objects inside reports and print multiple reports, each from a different query and with its own format and data representation (e.g., charts and tables) on the

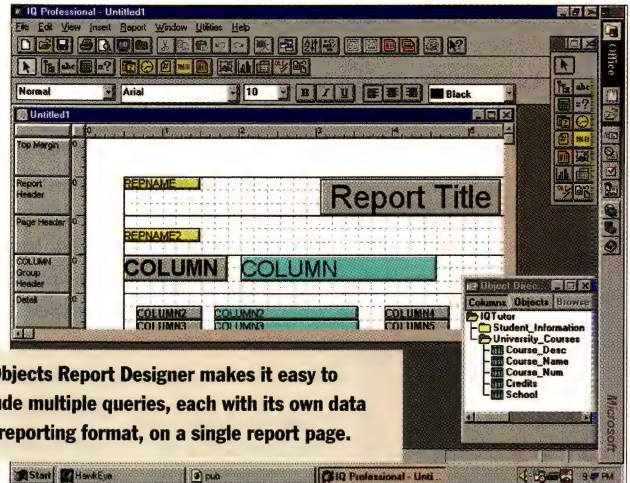
same page. You can define 2-D and 3-D cross-tab reports using single or multiple columns and put multiple objects in cross-tab cells.

IQ/O offers eight types of graphs, including pie charts, bar charts, scatter diagrams, and line charts. Report developers can include logical print objects and report areas that appear only when a predetermined condition is met. This means you can create reports having multiple detail and summary sections with different formats (e.g., each specific to a given state), and the appropriate query and format will be automatically chosen at run time. Also, you can use the results of one query as input to another.

Using IQ/O, you can create custom columns that extend a database's physical schema, and you can also create user-written functions to manipulate data and perform calculations. IQ/O provides complete control over formatting, allowing borders, shadows, background images, and fills for objects, selected report areas, and the entire report. You can export your report to Windows metafiles and to text, comma-delimited, PostScript, and Excel files.

You design a report graphically, dragging and dropping columns from an object window to a report. IQ/O comes with several predesigned report templates, and you can add custom templates. Group editing lets developers change multiple objects at once, and you can define and apply object styles as needed. You can browse data while you're designing a report and see on-screen what the report will look like, eliminating the need for most test printing and saving time and materials.

The object-oriented structure of IQ/O lets you create reusable objects—reports, charts, queries, and documents, as well as imported OLE objects—and incorporate them into new queries and documents.



IQ/O can link report objects so that an object will change automatically when you change another object that's linked to it. This saves time in report maintenance.

Report output can be saved for later viewing either in IQ/O or by the separate, smaller IQ Viewer that's included with the less-expensive personal edition. You can also create prompts to make it easy for users to request reports directly.

While IQ/O can do its query processing entirely on a workstation, it can also off-load some of the computing to one or more IQ SmartServers. These can query back-end databases, create formatted reports and views, and ship the query results back to the workstation.

PowerPlay

PowerPlay is a suite of four programs that lets developers and end users create interactive reports and graphs and perform some what-if analysis. PowerPlay comes with Explorer, Reporter, Portfolio, and Transformer components, plus a separate Cognos Scheduler.

PowerPlay Explorer provides a point-and-click interface to check out data. Transformer takes 2-D data from database tables and creates the multidimensional data that Explorer and Reporter use. Portfolio organizes PowerPlay reports into interactive briefing books. Cognos Scheduler can execute Transformer as a batch process at specified times. *continued*

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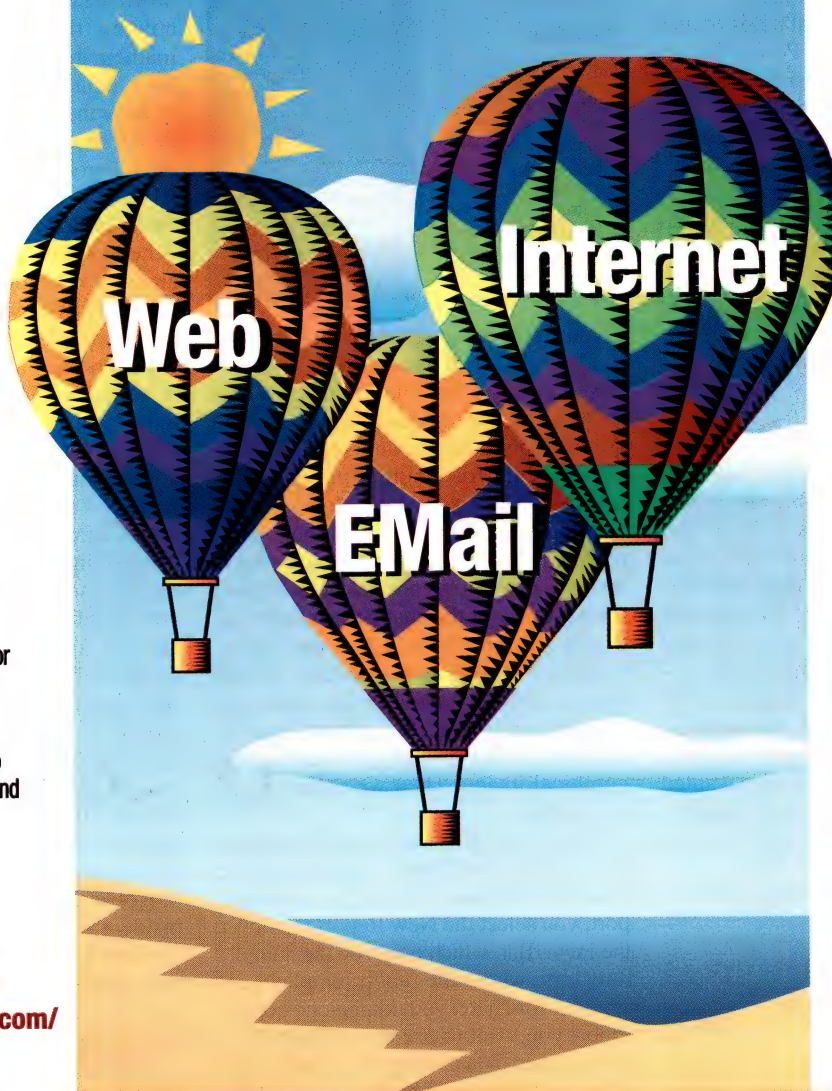
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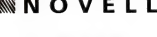
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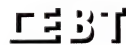
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Tame the Network

Get a better grip on your LAN or WAN with one of these management programs

TADESSE W. GIORGIS

Network administrators need an easy way to track down their company's hardware and software assets. They also need tools to distribute and install software automatically during off-peak hours. And when users call the in-house help desk, support personnel should be able to fix problems remotely. Printer and queue management, centralized virus protection, and storage management are added bonuses.

For this roundup, we looked at five network management products that address these desktop issues. All provide server and workstation management, inventory control, electronic software distribution (ESD), software metering and license control, and network monitoring. We did not test device- and wire-management programs for this review.

The reviewed products fall into two functional categories. Microsoft's Systems Management Server (SMS), like LANdesk Management Suite, supports SNMP and DMI for inventory collection. It requires Microsoft SQL Server to manage the resulting data ①, and it lets you tailor the format of query results to suit the hardware architecture ②.

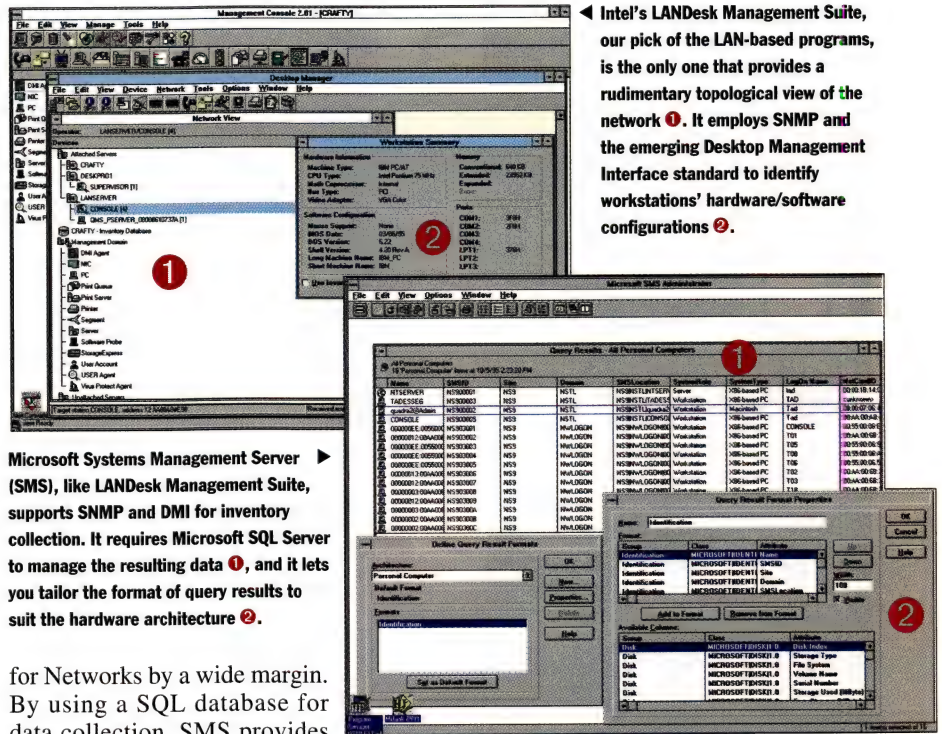
Microsoft Systems Management Server (SMS), like LANdesk Management Suite, supports SNMP and DMI for inventory collection. It requires Microsoft SQL Server to manage the resulting data ①, and it lets you tailor the format of query results to suit the hardware architecture ②.

for Networks by a wide margin. By using a SQL database for data collection, SMS provides an excellent platform for building an enterprise-wide management infrastructure.

McAfee's BrightWorks

With its excellent on-line references, good report writer, and versatility, BrightWorks nips at the heels of LANdesk Management Suite for top honors. It's a good choice for administrators managing a NetWare environment.

Intel's LANdesk Management Suite, our pick of the LAN-based programs, is the only one that provides a rudimentary topological view of the network ①. It employs SNMP and the emerging Desktop Management Interface standard to identify workstations' hardware/software configurations ②.



Though the BrightWorks help system is a bit skimpy, its Adobe Acrobat viewer makes accessing the well-organized on-line manuals easy. Like Microsoft SMS, it comes with Crystal Reports. This software gives you lots of flexibility in designing and generating reports, as well as importing data from ODBC-compliant databases. Only LANdesk Management Suite's reporting tool is comparable.

continued

The Manager's Choice

Intel's LANdesk Management Suite is the best in the LAN category, as well as the best overall. It has a comprehensive and well-integrated set of tools for NetWare LANs, an excellent tutorial, and a good reporting engine. Its modules for monitoring applications, traffic, and servers are especially good.

For WANs, Microsoft's SMS beats Norton Administrator

NETWORK MANAGERS: HOW THEY STACK UP

NIST RATING		VERSION	PERFORMANCE	QUALITY	VERSATILITY	EASE OF LEARNING	EASE OF USE	PRICE *
LANs Only								
★★★★	LANdesk Management Suite	2.01	▲	▲	▲	▲	▲	\$5000
★★★	BrightWorks	2.10	▼	▲	▲	▲	▲	\$4000
★★	Frye Utilities for Networks	2.0	▼	■	▲	■	■	\$3275
LANs and WANs								
★★★	Systems Management Server	1.1	▲	▲	■	▲	▲	\$3275
★★	Norton Administrator for Networks	2.0	▼	■	■	▲	▲	\$4400

KEY

★★★★ Outstanding
★★★★ Excellent
★★★ Average
★★ Below average
★ Poor

▲ Good
■ Fair
▼ Unacceptable

* Approximate cost for 100 user connections

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MANAGEMENT/ADMINISTRATIVE FEATURES

	BRIGHTWORKS	FRYE UTILITIES FOR NETWORKS	LANDESK MANAGEMENT SUITE	NORTON ADMINISTRATOR FOR NETWORKS	SYSTEMS MANAGEMENT SERVER
Server Management					
Provides server disk/volume information and management	●	●	●	○	●
Security and user account management	●	●	●	○	●
Printer and queue configuration management	●	●	●	○	○
Backup and restore server configuration data	○	○	○	○	○
Ability to set server baseline values	●	●	●	○	○
Monitors server to gather statistics	●	●	●	○	●
Accepts threshold values	●	●	●	○	○
Workstation Management					
Monitors workstation to gather statistics	●	●	●	●	●
Remote control of client workstations	●	○	●	●	●
Ability to identify and correct application problems	○	○	○	●	●
Accepts threshold values	●	●	○	○	○
Tracks file access and application usage	●	●	●	●	○
Inventory					
Collects data about file server hardware	●	●	●	○	●
Collects data about file server software	●	●	●	○	●
Identifies changes in setup files (CONFIG.SYS, etc.)	●	●	●	●	●
Allows purging of inventory database	●	○	●	●	●
Application software metering					
Generates alert when license is exceeded	●	●	●	●	○
Blocks execution when license is exceeded	●	●	●	●	○
Provides report on application usage	●	●	●	●	○
Electronic software distribution					
Allows OS installation	●	●	●	●	●
Provides script for creating distribution list	●	●	●	●	○
System Administration					
Allows defining of sites and domains	●	①	●	●	●
Has SQL database engine	○	○	○	○	●
Management program has built-in OLE API	●	○	●	○	●
Database files protected by password	○	●	○	○	●
Can specify user access levels	○	●	○	○	●
Shows free server disk space (in percent)	●	●	●	○	●
Shows free workstation disk space (in percent)	●	●	○	○	●
Shows server use (in percent)	●	●	●	○	○
Lets you adjust system files, shut down and restart server	○	●	○	○	○
Report Types (partial list)					
Network utilization report	●	●	●	○	○
Inventory report	●	●	●	●	●
File server configuration	●	●	●	○	●
Workstation configuration	●	●	●	●	●

● = yes; ○ = no

① NetWare-dependent groupings only

on a sophisticated SQL database manager.

Microsoft Systems Management Server

For companies with geographically dispersed LANs and mixed networks, Microsoft SMS is the best choice. It combines high quality, ease of use, efficient performance, and decent versatility. SMS lacks software metering, but it is excellent at software distribution and has very good inventory components. Extensive on-line help and tutorials guide you safely through complicated tasks.

To provide a SQL database engine for its management product, Microsoft designed SMS with slightly higher resource needs than its competitors. Besides a full-scale copy of Microsoft SQL Server running with Windows NT Server 3.51, SMS requires 28 MB of RAM. Additional management consoles also require Windows NT Server or NT Workstation 3.51. SMS has a complex setup procedure; but, once up and running, its drag-and-drop interface and good on-line documentation make it easy to use.

SMS also has the most complete security system, and its performance is comparable to that of Intel's LANdesk Management Suite. It is alone with the Intel product in supporting the Desktop Management Interface (DMI), an emerging standard for identifying and managing network components. ■

This report contains the partial results of a recent issue of Software Digest, a monthly publication of NSTL, Inc. To purchase a complete copy of the report, contact NSTL at 625 Ridge Pike, Conshohocken, PA 19428, (610) 941-9600; fax (610) 941-9950; on the Internet, editors@nstl.com. For a subscription, call (800) 257-9402. BYTE Magazine and NSTL are both operating units of the McGraw-Hill Companies, Inc.

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Boston, MA
(800) 234-3793
fax: (617) 753-0484
mail@frye_BOS.MHS.compuServe.com
Circle 1130 on Inquiry Card.

LANdesk Management Suite 2.01\$595
(five-node license; \$50 per node over 100;
\$40 per node over 1000)
Intel
Hillsboro, OR
(800) 538-3373
fax: (503) 264-7579
<http://www.intel.com>
Circle 1131 on Inquiry Card.

Norton Administrator for Networks 2.0\$50 per node
(10-license pack;
\$37 per node for 1000 licenses)
Symantec
Cupertino, CA

(408) 253-9600
fax: (408) 973-9340
<http://www.symantec.com>
Circle 1132 on Inquiry Card.

Systems Management Server 1.1\$649
(server license; \$54.95 client license;
\$34.95 for more than 100 clients)
Microsoft
Redmond, WA
(800) 552-9876
fax: (206) 936-7329
<http://microsoft.com>
Circle 1133 on Inquiry Card.

StrongARM Tactics

**This amazing little RISC chip has
PDA written all over it**

DICK POUNTAIN

The handwriting is on the wall: Personal digital assistants (PDAs) need more horsepower if they're ever going to excel at handwriting recognition and other CPU-intensive tasks. And the breakthrough that might carry PDAs to the next level may be a new RISC chip called the StrongARM.

This fascinating microprocessor is a joint project of Digital Equipment and Advanced RISC Machines (ARM). Digital, of course, makes the Alpha AXP family, the fastest RISC processors in the world. ARM makes the ARM610 and ARM710 processors that drive Apple's Newton MessagePad and 3DO's home-videogame machines. The StrongARM is founded on a hybrid technology that combines the raw power of the Alpha with the super-efficient power consumption of the ARMs.

It's a combination tailor-made for PDAs. The conflicting requirements of high speed, low power consumption, and a small chip package rule out the vast majority of off-the-shelf microprocessors.

The first StrongARM will be a 1.5-volt chip that runs at an astonishing 160 MHz. That might seem slow compared to the 333-MHz Alpha 21164, but it's four times faster than the speediest chip currently available from ARM, and it blows away everything else at this low voltage. A 2-V, 215-MHz StrongARM will follow shortly. For the first time, a CPU that outperforms a high-end Pentium will be available for use in battery-powered PDAs.

"At these performance levels, handwriting recognition stops being a hard problem, and voice recognition is what you can start to worry about," says Dave Jaggar, ARM's market-development manager.

Fabricating for Low Power

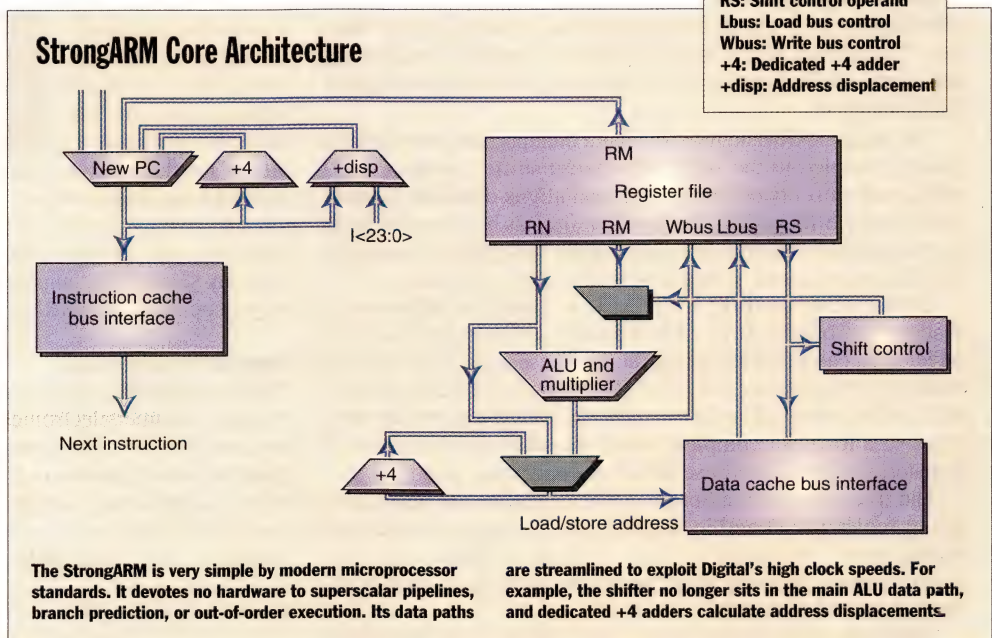
Creating a hybrid design like the StrongARM isn't as simple as gluing together two architectures as disparate as the Alpha and the ARM. To attain the desired

clock speeds, engineers from both companies worked together to redesign the whole data-path and cache structure of the CPU. Nevertheless, Digital's leading-edge fabrication process is ultimately what permits the StrongARM to run four times faster than previous ARM chips. The architectural changes exploit the speed of this silicon.

Digital's newest fabrication plant uses a next-generation process called CMOS-6, the same process Digital uses for its Alpha 21164A, which will exceed 350 MHz. It's a 0.35-micron, four-layer-metal CMOS process that yields high-speed, low-voltage transistors, thanks to extremely thin oxide insulation layers only 65 angstroms deep. Ultimately, this process will yield transistors that run at 0.9 V.

Low voltage is a crucial design point because power consumption varies with the square of the voltage. A chip fabricated on the 2-V CMOS-6 process will consume only 37 percent as much power as a chip fabricated on a comparable 3.3-V process. At 1.5 V, the power consumption is only 21 percent as much. The small feature size also reduces capacitance, saving even more power.

The actual die size will depend on how much cache memory is on the chip. Although this hasn't been announced the first StrongARMs will probably have 32 KB of primary cache. By any measure, however, the StrongARM core is tiny—a mere 115,000 transistors, compared to 3.3 million on a Pentium. Digital and ARM say their goal is to achieve performance of at least 300 million instructions per second per watt, at a cost of about 35 cents per MIPS. The first StrongARM chips are expected



Is Your Network Secure?

Securing your corporate network while connecting to the Internet doesn't have to be difficult. Just start with a good foundation.

DAN THOMSEN AND WINN SCHWARTAU

When building new systems, there are always design trade-offs to be made between functionality and security. Do we include the cool widget or that boring, constraining security feature? Historically, the widget usually won. But as Internet connectivity grows, a new class of criminals is causing electronic mayhem and committing crimes.

Despite the fact that strong, easy-to-manage information security is on the top of corporate wish lists, it is often pushed to the bottom of the heap when it comes to implementation. Security is never free, but you can reduce the cost of secure systems by creating flexible security mechanisms as a solid base to build on. Type enforcement is a straightforward security mechanism that provides the flexibility to balance security and functionality.

The Dawn of Computer Security

In 1985, the federal government published the first set of computer security criteria that computer professionals could understand and build into systems. Officially called the Trusted Computer Security Evaluation Criteria, it is more popularly known as the Orange Book. It offers a range of ratings for secure systems. The ratings start with D, for systems with no security, and go to A1, which requires formal methods to verify security.

One of the key elements of the Orange Book was mandatory access control, where all the resources in the computer (i.e., users, files, services, and programs) are labeled with a security level, or sensitivity. The label identifies the degree of sensitivity of each resource, such as Unclassified, Confidential, Secret, and Top Secret. Labels effectively assign the data on the system to separate “buckets.” The goal, or security policy, is to keep sensitive data from getting into the least-sensitive bucket.

Many initial Orange Book implementations were too restrictive. The federal government funded seven years of R&D to create a flexible implementation. At the heart of this solution is the type-enforcement security model.

Type Enforcement

Type enforcement is a security mechanism that gives every program on the system permission to do only those things it requires to do its job. This is called *least privilege* and applies to applications, files, and OSes.

Type enforcement works by grouping all the processes

of the system into classes based on least privilege. Each process group is called a domain. In a similar manner, the files on the system are grouped into classes called types. The Domain Definition Table on page 156 describes each domain's access rights for each type. The table

cannot be changed while the system is running.

The DBMS can interact only with database files, and the text editor can interact only with user files. The World Wide Web server can read user files but not modify them and is the only domain with access to the network. A similar table is constructed for controlling how domains can interact with each other.

One of the most important file types is the executable file. Tight controls are placed on which programs can be executed in a domain and who can modify them. Destructive software, such as viruses and Trojan horses, can be stopped cold because they cannot modify the executable files.

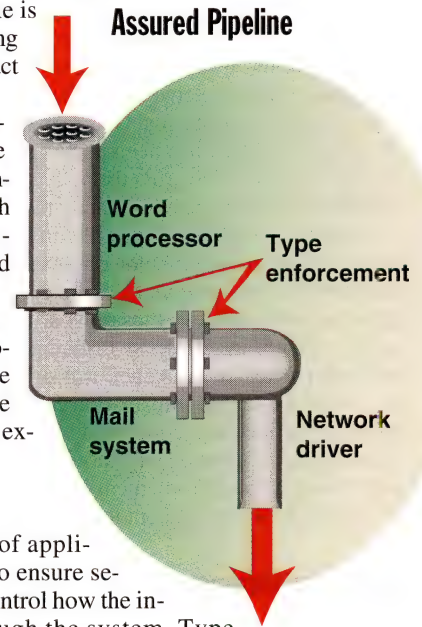
Assured Pipelines

Providing separation of applications is not enough to ensure security; you must also control how the information flows through the system. Type enforcement creates a kind of pipeline to organize data flow between programs (see the figure “Assured Pipeline” above).

Many applications are part of larger systems. To assure that information moves securely, type enforcement controls the data each program can read and write. Each program can only read from the stage in front of it and write to the next stage of the pipeline. No stage of the pipeline can be skipped, and how the data flows through the system is tightly controlled.

A divide-and-conquer approach to building secure applications is another advantage of assured pipelines. By splitting a large program into smaller pieces, it is easier to analyze and be sure the pieces are operating correctly.

For example, suppose you wanted all the outgoing mail messages to be digitally signed before leaving your network, to prove who sent the message. You could modify the word processor to include the digital signature, but it



Clean Up: C++ Garbage Collection

Here's a tool that helps you keep your code clean by taking out the trash

JUSTIN MILLER

Every C++ programmer at one time or another has had the following problem: Somewhere, somehow, your program calls `new` more times than it calls `delete`. Or perhaps it's the inverse: Your program tries to use an object that's been deleted. Maybe it deletes an object more than once—perhaps two, even three times.

These related problems can manifest themselves in mysterious ways. A temporary string object doesn't get deleted; your program continues to run but inexplicably exhausts memory. Other times, the manifestations are not so mysterious. A routine attempts to dereference a pointer that is pointing to a deleted object and the whole program crashes spectacularly.

It's difficult to keep track of all the objects you have to delete. Consequently, during design time, you're forced to repeatedly ask: "When is it safe to delete this object?" Because this is often a tough question to answer, this ongoing wrestling match with memory almost always complicates your design. And even the most meticulous programmer makes an occasional error, leading either to a global protection fault (or its equivalent) or memory that's never freed.

Pandora's Box Closed

The solution to all this is a garbage collector. With a garbage collector, you never have to delete anything. The collector automatically deletes an object when your program no longer references that object. If you've seen garbage collectors, you're probably concerned about their performance. Some work by "waking up" intermittently and searching through memory for objects that can be deleted. This can bog down the application.

The speed of a garbage collector depends on its type. The most general types of garbage collectors—which do, in fact, search through memory—are slow if you compare them to "manual" memory management (i.e., explicitly using `delete`). However, most of the time your program won't need such a complicated collector. A reference-counting garbage collector is sufficient.

A reference-counting garbage collector is fast because it doesn't have to search through memory. Instead, for every object, it keeps a running count of the number of pointers that point to that object (this running count is the object's "reference count"). Every time a pointer is assigned to point to an object, that object's count is incremented. Every time a pointer is reassigned to point to a different object, the original object's count is decremented,

and the count on the object to which the pointer is newly assigned is incremented. Also, every time a pointer goes out of scope, the count for the object to which it pointed is decremented.

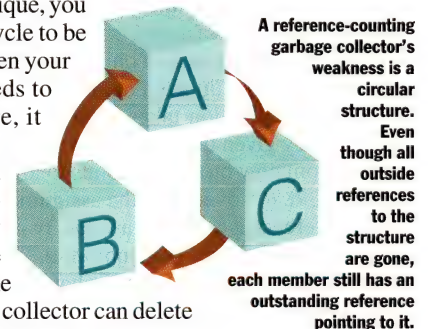
Because the garbage collector keeps track of the number of pointers referencing the object, it knows that when the reference count for an object reaches zero, the object can be safely deleted (if there are no pointers to the object, your program can't access the object).

Limitation

The only drawback to such a garbage collector is that it can't "collect" cyclical structures. For example, suppose you have three objects, A, B, and C. They are tied to one another in the form of a circular list: A contains a pointer to B, B contains a pointer to C, and C contains a pointer to A. Initially, some other pointer may have pointed to A, but that pointer has gone out of scope and, consequently, this circular structure is no longer accessible from your program. It should be put in the garbage.

However, since each object points to the next member of the loop, each of these objects still has one outstanding reference. As a result, a reference-counting garbage collector won't collect the members of this structure; they will be "leaked."

If your program does include a circularly linked list, that doesn't mean you *cannot* use a reference-counting garbage collector. You can arrange to have the garbage collector properly delete the structure, using what I call the "linchpin" method. With this technique, you pick one object in the cycle to be the linchpin object. When your program no longer needs to use a circular structure, it pulls the linchpin; that is, your program sets all pointers inside the linchpin object to null, thereby breaking the loop. Since the loop has now become a linear list, the garbage collector can delete the remaining objects appropriately.



C++ to the Rescue

At this point, though you may be inclined to agree that a reference-counting garbage collector would be a fine programming tool, you're probably concerned about the time you'd have to spend to build one. And if you do decide to build one, you must be exceedingly careful in its construction: Any errors in the reference-counting code of the collector would produce an unacceptably leaky garbage collector.

continued

More Control, Fewer Headaches

You can cut support costs and hassles with integrated configuration management tools

SALVATORE SALAMONE

If you're a network administrator, you crave control. You've probably got a list of tools you'd like for that purpose. A centrally administered menu (in the form of a Program Manager-like shell) on each desktop could help control how users access networked applications and control what users have access to. This kind of control can reduce LAN support costs.

A configuration management tool can help you manage all those desktops. Several vendors, such as Novell, Symantec, McAfee Associates, and Computer Knacks, offer such tools today. Typically, these packages allow a manager to edit WIN.INI files, script commands, and limit a user's desktop choices (for example, by removing the DOS-prompt option or by making "Open" under the File menu nonfunctional).

The desire for configuration management is not limited to Intel-based PCs running Windows. Last year, configuration management was one of the factors that earned Digital Equipment's Multia MultiClient system the BYTE Best of Comdex award in the category of desktop computers (see "Notebooks, NT Clusters Capture Awards," February 1995 BYTE). The Multia is essentially a low-cost Alpha-based Windows NT workstation that comes bundled with configuration management features. One of the main advantages of Digital's Multia line is the set of configuration tools; they give users a lot of control over their desktop environment.

Integration with OS and NOS

Configuration management tools are becoming more tightly integrated with either the network operating system or with systems management tools. For example, rather than just linking an icon on a user's screen to an application on a specific server, a configuration management program might link the execution of an application with a software metering program. In that way, when all the licenses for a particular application are used up, the icon associated with that application would no longer be displayed on a user's screen. Or, you might connect levels of access (e.g., read-only vs. write) with an organizational structure previously defined in a Novell Bindery or network directory service. So when a new sales associate is added to the network, for example, that person would automatically be able to look up customer account information, while a newly added sales manager would automatically be given the privilege to make changes in customer files.

Configuration management of the desktop is becoming increasingly popular because many managers see it as a way to reduce their rising LAN support costs. Over a five-year period, the average cost per user for LAN support is \$3278, according to

the Gartner Group. That's more than \$2 million per year, on average, for a 700-node LAN. In contrast, the average annual cost per user for equipment (including network server hardware, desktop adapter cards, cabling, hubs, connectivity software, and installation fees) is only \$885 (most of which is spent in the first year when equipment is purchased).

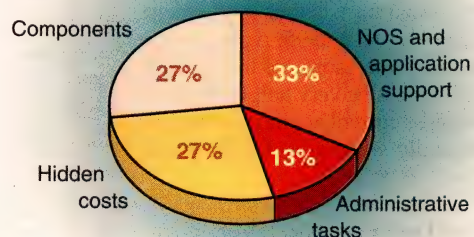
A cost-of-ownership study by the Meta Group found similarly high numbers for LAN support. Meta estimates that the cost per client over a five-year period is \$19,504 (or about \$3900 per client per year).

Configuration management tools can reduce the administrative burden on a LAN staff in a number of ways (see the list on page 160). By replacing the standard Windows Program Manager with a centrally administered desktop manager, you can get rid of many potentially confusing options. For example, you might provide icons only for programs the user has access rights to. Or, you can remove the Properties Menu option on a user-by-user or group-by-group basis to prevent tampering.

At a higher level, you could integrate network rights into the desktop environment to reduce administrative tasks. For example, if the marketing group is allowed access to a graphics application, adding a user to the marketing group in SYSCON would make the graphics application icon appear on the user's desktop automatically. Therefore, double administration is not required.

User interfaces also make it easier for people to get at networked applications and resources. Users need only

Where LAN Support Dollars Go



It costs an average of \$3278 per year to support an average LAN user, according to analysts at the Gartner Group (Stamford, CT).

JERRY POURNELLE

Dead Chickens and Portable Data

Years ago, I told the VP of marketing at AT&T that if they bought KFC, they'd end up advertising hot, dead chicken. He sighed and said, "The worst of it is that we'd probably advertise warm, dead chicken."

So AT&T bought NCR and turned it into AT&T Global Information Solutions. Having admitted they couldn't market a cure for death, AT&T took a company that could market small computers and slaughtered it. While they were at it, they let NCR wring the neck of AT&T's most exciting product, the Safari laptop. It was one of my favorite laptops—small, very portable, built-in communications. While AT&T desktop marketing wasn't very hot, they had some good technology, and they were beginning to move with the Safari. After NCR was dragged in, no journalist I know ever heard from either AT&T or NCR again. The Safari was never updated—if there are new models, I never got the word. We can't review what we don't hear of.

It's up to marketing to make us aware of new products, or at least that there *are* new products, because I guarantee you there are plenty of outfits out there who *do* let columnists know. I confess I hadn't thought of AT&T for a year when I was reminded by a *Wall Street Journal* article of just what a fiasco the AT&T/NCR merger became.

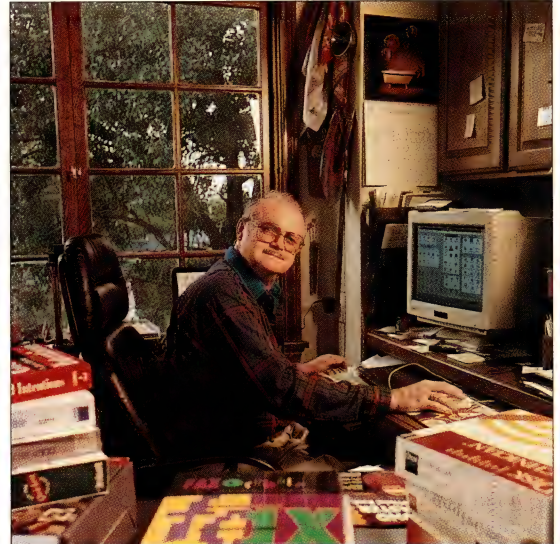
The pity of it all is that if ever there was a company that ought to be booming in these days of Internet and Unix popularity, it surely ought to be AT&T. Who else would be better suited to sell you a Unix box that you can hook directly to the Internet? I used to have one here at Chaos Manor. Perhaps there's an updated system, but if so, they sure haven't let me know about it. Alas.

Every now and then I get a panic E-mail message about disk drives with lost chains, cross-referenced or nonmatching file allocation tables (FATs), and other disk woes. Alas, I don't have time to do more than send a generic answer. I usually advise them to try Norton Disk Doctor run from a floppy disk. I figure that if they had

Norton Utilities (NDD comes with NU) already installed on the hard disk, they'd have tried NDD and said so. In any event, the one thing you don't want to do if you have a disk in trouble is install something new on it or write to it in any way.

NDD allows you to make an Undo disk that will put things back the way they were. You can put that on a floppy disk or on a network disk (*never* on the disk you're working on!). As long as you do that, you're reasonably safe, with one exception I'll get to in a second.

If NDD fails, your next step depends on how important the data is. If all you stand to lose is a few hours of installation time, you can try mucking about with NU yourself. For example, DOS keeps two copies of the FAT. They're supposed to match, but sometimes they don't. If you know which one is good, you can tell NU to use the good one and ignore the other. There are other such tricks. All are fairly dangerous in that you can lose your files forever, but that's the worst that can happen. If that won't be a complete disaster, you can use NU to try to recover from some stupid application that wrote garbage in



Jerry offers advice on disaster recovery and looks at ways to access data—anywhere

and right on up to World War I. All the major documents, such as Magna Charta, the Mayflower Compact, Declaration of Independence, Articles of Confederation, and Constitution are there. So are the entire Federalist Papers. There are eyewitness accounts, literary works, Washington Irving, and so forth.

But there's more. You get Woodrow Wilson's six-volume work, *History of the United States*. There are all the inaugural addresses of the presidents. There's James Madison's two-volume *Journal of the Constitutional Debates*. There is, in a word, nearly every original source and most secondary sources needed to teach American history, all indexed and searchable.

The viewing engine is Folio Views, about which more later. There's one quirk you need to know about. To make it easier to find and copy material from this wonderful collection, there is extensive paragraph identification, useful for scholarly quoting but annoying if you're just trying to read the documents. It's neither intuitive nor documented, but you can turn that off. Pull down the View menu, and click on the item Hidden; that will toggle the paragraph identifications.

Every schoolroom and home student in America ought to have this disc. It's that good. Highly recommended.

Attendees at Comdex and other computer shows know something about Folio Views, because for the past few years, the convention directory has been given out on a floppy disk. BYTE chooses the Best of Comdex show awards, and the Folio Views-based disk sure has made my life easier. I can search out new products by category, find booth and suite numbers, and suchlike. This year, I am going to take the neat little Citizen PN60 printer and use that to make out my show itinerary.

The Folio Views 3.1 Infobase Production Kit builds databases you can take with you. It comes in several levels, from a simple user database construction kit through a professional kit that includes licenses that let you distribute the run-time viewer with your product—that's what comes with the American-history CD—to a Software Developer Kit that lets you extend their tools and hook the whole thing in with other programs. It's all industrial-strength software and priced accordingly. It's also pretty solid.

You can get your data nearly anywhere, provided you respect applicable copyright restrictions, of course. Nexis and Lexis are obvious sources, but in fact almost any Internet site may furnish one. If you have any level of Folio Views, you can get a

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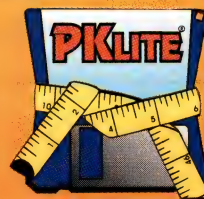
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Internet access; and most Web browsing is done by mousing around. You can also "type" short replies with the stylus: you call up an image of a miniature keyboard and tap away at the keys. That's frustrating for touch-typists, but hunt-and-peck addicts get pretty fast with it.

The real merit of CruisePad is for structured actions. Years ago, I speculated that one day doctors making hospital rounds would have a clipboard computer that would give them the patient's chart, let them make entries, digest the information, and offer suggestions on diagnosis and treatment. That's no longer speculation. Teaching hospitals are testing such systems. You can even enter prescriptions with CruisePad. The result probably won't be reliably machine-readable, but the handwritten bit map can be attached to the patient's chart, a copy can go by fax to the pharmacy, and a clerk can complete the data entry from a central location.

I don't know if anyone is doing this now, but it wouldn't be difficult to construct a program that compares the recommended treatment with what is standard; does the same thing with dosages, taking into account the patient's body weight; looks in the record for contraindications;

and flashes a warning if the physician has specified something outside the normal envelope. That would certainly eliminate careless errors.

To go from the sublime to something else, muffler and transmission shops are also using CruisePad. Tap the screen, and up comes a list of makes and models. Use the stylus to let the computer know the model and year, and up comes a picture and a list of symptoms. Tap (as opposed to click) in the appropriate places, and out comes a repair recommendation and cost estimate.

The U.S. Navy is trying to replace paper with CD-ROMs. The problem with that was summarized by Gordon Eubanks, who was a submarine driver before becoming CEO of Symantec. If you're crawling around inside an engine trying to find out where to put a wrench, the last thing you need is to have to come out to look at a screen. With CruisePad, you can carry the screen with you, and as long as data access is mouse-controllable, it would be plenty good enough.

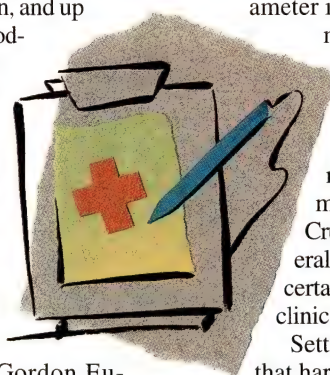
To utilize CruisePad, there are three ways

to connect to your network: CruiseLAN/PCMCIA, for computers with a PC Card Type II slot; CruiseLAN/ISA, a card for AT-type bus desktop PCs and servers; or CruiseLAN/Access Point relay boxes, for extending coverage to up to 1000 feet in diameter in normal office environments.

With a CruiseLAN/Access Point connected upstairs, I was able to control SuperCow from every downstairs room. A larger establishment like a hospital could put CruiseLAN relay boxes in several places; one would almost certainly be enough for a small clinic or mechanic's shop.

Setting up CruisePad isn't all that hard, but you do have to get the drivers loaded in just the right order and just the right way, and that can be tricky. Small companies without technically competent people may want some help, either from a franchising parent organization or outside consultants, to get it running.

Designing the custom database applications to make CruisePad useful is a much bigger deal. On the other hand, given tools



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Social Security and other entitlement increases are keyed to it, getting it right can be the difference between government solvency and bankruptcy. Everyone is sure it's wrong. There's no agreement on new ways to compute it, but at least small computers make adjustments possible.

GDP is in many ways more important than CPI; and my guess is that small computers will make it possible to adjust it so it discriminates between production and crime. All we have to do is agree on how.

The computer book of the month is by Charles Kaufman, Radia Perlman, and Mike Speciner, *Network Security: Private Communications in a Public World* (Prentice-Hall, 1995); it's both readable and complete, and if you have anything to do with network security, you need this book.

One last bit of advice: if you have W95 running stably, be very careful how you muck with it. More on that next month. ■

Jerry Pournelle holds a doctorate in psychology and is a science fiction writer who also earns a comfortable living writing about computers present and future. Jerry welcomes readers' comments and opinions. Send a self-addressed, stamped envelope to Jerry Pournelle, c/o BYTE, One Phoenix Mill Lane, Peterborough, NH 03458. Please put your address on the letter as well as on the envelope. Due to the high volume of letters, Jerry cannot guarantee a personal reply. You can also contact him on the Internet or BIX at jerry@bix.com.

Every schoolroom and home student in America ought to have **CDSOURCEBOOK of American History** (\$49.95). It's that good. Contact Compact University, Provo, UT, (800) 677-3045 or (801) 375-2227; fax (801) 375-2228; sales@infobases.com. **Circle 1087 on Inquiry Card.**

To utilize **CruisePad** (\$1399), there are three ways to connect to your network: CruiseLAN/PCMCIA (\$695), for computers with a PC Card Type II slot; CruiseLAN/ISA (\$595), a card for AT-type bus desktop PCs and servers; or CruiseLAN/Access Point (\$1895) relay boxes, for extending coverage to up to 1000 feet in diameter in normal office environments. Contact Zenith Data Systems, Buffalo Grove, IL, (800) 533-0331 or (708) 808-5000; fax (708) 808-4434; http://www.zds.com. **Circle 1088 on Inquiry Card.**

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A portable x,y digitizer with an accuracy of 0.003 inch, the Rat (\$1895) can digitize most cartographic features as well as pictures and drawings. By using the Rat's grid plot overlays, you can digitize without a known coordinate system. The included Diggis software



captures map, drafting, or generic data and exports it into your favorite GIS or CAD program running under DOS, Windows NT or

95, Unix, OS/2, or the Mac OS. Contact: Digi-Rule, Inc., Calgary, Alberta, Canada, (403) 292-0320;

<http://www.digirule.com>.

Circle 979 on Inquiry Card.

PENTIUM MULTIMEDIA SUPER-NOTEBOOKS

Based on the PCI-bus architecture, the Eurocom 5400 Multimedia Super-Notebooks (starting at \$2900) come with 75-, 90-, 100-, 120-, or 133-MHz Pentium CPUs; 256 KB of external L2 write-back cache memory (expandable to 1 MB); 8 MB of RAM (expandable to 32 MB); 2 MB of video memory; an internal quad-speed Teac CD-ROM drive; a removable 2½-inch hard drive with capacities of 340 MB to 1.3 GB; 16-bit stereo sound with an FM synthesizer; a trackpad; an oversize 86-key keyboard; one PC Card Type III slot or two Type II slots; an infrared communications port; a UART 16550 se-

rial port; an ECP/EPP-compatible parallel port; an external keyboard/mouse port; an external VGA port; a game port; and a 200-pin connector for a docking station. The notebook is available with 10.3-/11.5-inch color DSTN dual-scan passive-matrix or 10.2-/10.4-inch color TFT active-matrix LCD panels. The NiMH battery pack gives you 1.5 to 2.5 hours of operating time.

Contact: Eurocom Corp., Nepean, Ontario, Canada, (613) 224-6122.

Circle 993 on Inquiry Card.

LABEL PRINTER ►

With the K225 On-Line Labeler (\$269), you can print in a variety of fonts and type sizes; horizontal or vertical; flush top, bottom, left, or center; and bar codes on labels up to 2¼ inches wide. The software saves label formats, organizes and saves frequently used addresses, and allows you to import graphics or scanned images onto labels.

DESKTOP PCs THAT OPTIMIZE WINDOWS 95

Available in low-profile and short-tower configurations, the Celebris GL desktop PCs (from \$2799) feature board-level integration of audio, video, and networking. Systems incorporate 90-, 100-, 120-, and 133-MHz Pentium processors; EDO memory; pipeline burst-mode cache memory; the Intel Triton FX chip set; and 64-bit graphics. The multimedia technology includes a Matrox Millennium graphics controller that offers 2-D/3-D graphics acceleration, 2 MB of dual-ported video memory (upgradable to 8 MB), 16-bit stereo sound, and a quad-speed CD-ROM drive.

Along with remote configuration/diagnostics, management, and troubleshooting, the Celebris GL can communicate information such as chassis and motherboard serial number, CPU speed, model name, memory installed, and BIOS revision to popular enterprise and workgroup management tools. Features that optimize Windows 95 include Plug and Play, DMI client support, Windows 95 shutdown software, Digital Equipment's integrated PCI Ethernet and Easy Network Setup utility, a Windows 95 keyboard, and Windows 95 "getting started" software.

Contact: Digital Equipment Corp., Maynard, MA, (800) 642-4532 or (508) 624-6400;
<http://www.pc.digital.com>.

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Contact: Kroy, Inc., Scottsdale, AZ, (800) 733-5769 or (602) 948-2222; info@kroy.com.

Circle 983 on Inquiry Card.

RAID STORAGE SYSTEM

The Renegade RAID System (with 10 4-GB 7200-rpm drive modules, about \$30,000) offers 42 GB of storage and fault-tolerant data protection con-

figurable to support RAID levels 0, 1, 3, 5, 6, and 7. The tower chassis stores up to 10 3½-inch drives, which support fast and narrow, or fast and wide, SCSI-2 and offer data transfer rates of up to 20 MBps. The system supports the hot-



swapping of drives, and the automatic rebuild function restores data on a new drive after there is a crash.

Contact: MountainGate Data Systems, Inc., Reno, NV, (800) 556-0222 or (702) 851-9393; sales@mntgte.lockheed.com.

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WORKGROUP FAX SOFTWARE

Running as an NLM, Faxcom/Workgroup for NetWare allows users on NetWare networks to send and receive faxes via a shared fax modem connected to a file server. The program supports Windows, OS/2, and DOS clients; manages private and public fax phone books; allows users to view, rotate, annotate, and forward faxes; and imports user information from bindery and NDS. Faxcom/Workgroup for NetWare (from \$695) also interfaces to scanners for converting faxes to text or for faxing hard-copy documents, and it provides an upgrade path for enterprise-wide integration with Biscom's multichannel fax servers.

Contact: Biscom, Inc., Chelmsford, MA, (800) 477-2472 or (508) 250-1800;

<http://www.biscom.com>.

Circle 1019 on Inquiry Card.

COMMUNICATIONS FOR OS/2

HyperAccess for OS/2 (\$129) offers telnet access to the Internet and comes with thousands of

ready-to-call BBSes, Internet service providers, and other on-line systems. The program supports data transfer rates of up to 57.6 Kbps on COM1-COM4 through standard OS/2 communications drivers, or rates of up to 115.2 Kbps through the included SIO .SYS shareware communications driver. You can also connect through TCP/IP and shared modems on OS/2 networks.

Contact: Hilgraeve, Inc., Monroe, MI, (800) 826-2760 or (313) 243-0576;

<http://www.hilgraeve.com>.

Circle 1004 on Inquiry Card.

DATA ACCESS AND REPORTING TOOL

IQ/Objects introduces object-based query and reporting using SmartObjects, which can make decisions to invoke or pass information to other objects based on query results. You can query data from different databases simultaneously, integrating and consolidating the results to reports for enterprise-wide decision support. Available config-

urations include Personal Edition (\$250), for executing, printing, and viewing queries and reports; Enterprise Edition (\$695), full-function query building and reporting; KnowledgeBase Administrator (\$995), which allows you to configure, define, and maintain access to multiple databases and includes Enterprise Edition; and IQ SmartServer (from \$5000), for intelligently distributing data access functions among clients, applications servers, and database servers.

Contact: IQ Software Corp., Norcross, GA, (800) 458-0386 or (404) 446-8880;

sales@iqsc.com.

Circle 1013 on Inquiry Card.

AS/400 CONNECTIVITY FOR WINDOWS 95

Emerald Client for Windows 95 (\$245) provides PCs running Windows 95 with IBM 5250 terminal and printer emulation to AS/400s. The program includes SQL capabilities, drag-and-drop bidirectional file transfer, an SDI function for multiple 5250 terminal sessions, access to the emulation screen, and a choice of connection methods from the PC to the host.

If you've been looking for speedy multiprotocol file transfers between Windows-based PCs and AS/400s, Emerald File Access (\$199) may be for you. The program provides query support using SQL, understandable error messages, efficient use of system resources on the host and PC, file transfer statistics, transfer of AS/400 Save files, security that lets system administrators restrict access to libraries and objects, and support for 16- and 32-bit OSes.

Contact: Andrew Corp., Orland Park, IL, (800) 328-2696 ext. 319 or (708) 349-3300.

Circle 1011 on Inquiry Card.

Software Update

Clarion for Windows 1.5 adds a 32-bit compiler to the RAD environment, so you can build applications for Windows 3.x, 95, and NT from the same development environment and project files. \$499.

Contact: TopSpeed Corp., Pompano Beach, FL, (800) 354-5444 or (305) 785-4555; 76711.1034@compuserve.com.

Circle 1021 on Inquiry Card.

Dfrag 4.0 defragments Oracle 6 and 7 databases, tables, and indexes; improves database performance; eliminates time-consuming maintenance tasks; and maximizes performance and space usage of Oracle databases. The Virtual DBA Windows-based graphical front-end interface lets Oracle database administrators graphically manage multiple Oracle databases spread across multiple servers from a single workstation. Single license, \$3500.

Contact: Aris Corp., Seattle, WA, (800) 431-2747 or (206) 433-2081; <http://www.ariscorp.com>.

Circle 1025 on Inquiry Card.

Track 3.1 for Windows, a LAN-based defect-tracking and technical-support system, provides integration of more choices of version control systems; additional reporting and analyzing features; a visual query builder; privileges needed for maintaining multisite databases; automatic notification capabilities via Lotus Notes, cc:Mail, and Microsoft Mail; ability to merge multiple databases and synchronize multisite databases; and additional import and export options, global search and replace, multiple indexing, and additional database-linking features. \$495.

Contact: Soffront Software, Inc., Milpitas, CA, (800) 763-3766 or (408) 263-2703; <http://www.soffront.com>.

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OLE CUSTOM CONTROLS

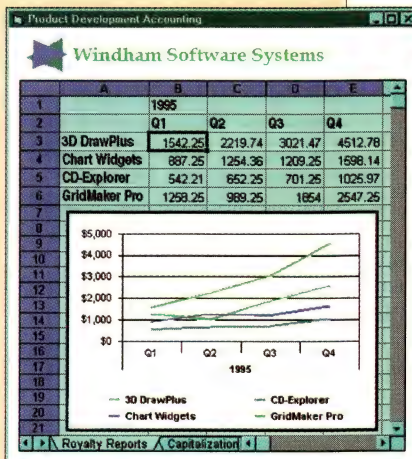
Available as OCXes, four components enable developers working in environments such as Visual Basic 4.0, Visual C++ 4.0, Access 95, Visual FoxPro, and Borland Delphi32 to build custom applications for Windows 95, NT, and 3.1.

You use Formula One 3.0 (\$249) for building spreadsheet-based applications, First Impression 2.0 (\$249) for creating charts and business graphics, VisualSpeller 2.0 (\$149) for checking your spelling, and VisualWriter 3.0 (\$249) for text editing and word processing.

Contact: Visual Components, Inc., Lenexa, KS, (913) 599-6500; 72204,3521

@compuserve.com.

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LTE 5000

Contura 420/430

Processor	Screen	HD	Price
486DX4/75	10.4" Dual Scan	420MB	\$2089
486DX4/75	10.4" Active	420MB	2559
486DX4/100	10.4" Dual Scan	720MB	2369
486DX4/100	10.4" Active	720MB	2939

LTE 5000 Series

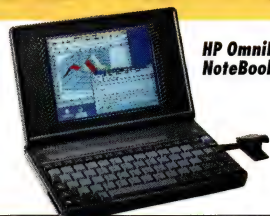
- Up to 120MHz Pentium power w/PCI bus & 256KB cache
- 32-bit PCI Local bus graphics
- 8MB RAM exp. to 72MB
- Built-in 16-bit sound, microphone & 2 speakers
- MultiBay — holds CD-ROM, 2nd HDD, Floppy, or 2nd battery.
- Up to 1.35GB hard drives (2.7GB max. capacity)
- Built-in infrared for wireless communications
- Supports NiMH & Lithium Ion batteries (up to 8 hrs.)
- Optional MPEG and TV video adapter

Processor	Screen	HD	Price
Pentium 75	10.4" Dual Scan	510MB	\$3799
Pentium 75	11.3" Dual Scan	810MB	4439
Pentium 75	10.4" Active	810MB	4729
Pentium 90	10.4" Active	810MB	5339
Pentium 90	10.4" Active	810MB	5599*
Pentium 120	10.4" Active	1.35GB	5379

*Features Built-In CD-ROM drive

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HP OmniBook 600
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HP OmniBook 600

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Processor	Screen	HD	Price
486DX4/75	9.5" Dual Scan	340MB	\$2539
486DX4/75	9.5" Active	340MB	2999

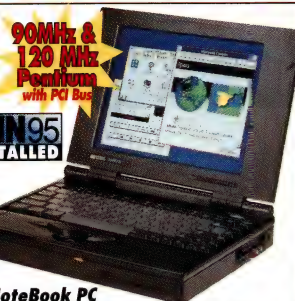
HP OmniBook 5000

- Pentium 90MHz with 32-bit PCI Local bus
- 1.2GB drives available for high capacity storage
- High resolution — 800x600 resolution on notebook display
- Built-in 16-bit sound, microphone & speaker

Processor	Screen	HD	Price
Pentium 90	10.4" Active	1.2GB	\$5329
Pentium 90	10.4" Active	1.2GB	5889*
Pentium 120	10.4" Active	1.2GB	6539*

*16MB RAM standard

HP OmniBook 5000 NoteBook PC



**90MHz &
120 MHz
Pentium
with PCI Bus**

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Processor	Screen	HD	Price
Pentium 75	10.4" Dual Scan	500MB	\$2639
Pentium 75	10.4" Dual Scan	800MB	2879
Pentium 75	10.4" Dual Scan	1.2GB	3249
Pentium 75	10.4" Active	800MB	3799
Pentium 75	10.4" Active	1.2GB	4199
Pentium 90	10.4" Dual Scan	800MB	3259
Pentium 90	10.4" Dual Scan	1.2GB	3639
Pentium 90	10.4" Active	800MB	4199
Pentium 90	10.4" Active	1.2GB	4579
Pentium 120	11.8" Active	800MB	4919
Pentium 120	11.8" Active	1.2GB	5199

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- 10.4" Active Matrix & 10.4" Dual Scan
- Built-in infrared for wireless communications

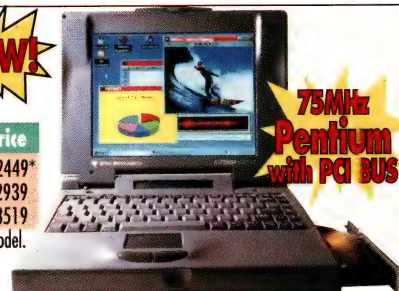
Extensa 550
as low as

\$2449*

Processor	Screen	HD	Price
Pentium 75	10.4" Dual Scan	524MB	\$2449*
Pentium 75	10.4" Dual Scan	524MB	2939
Pentium 75	10.4" Active	524MB	3519

*CD-ROM Drive is an optional accessory on this model.

Extensa 550CD



**75MHz
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with PCI BUS**

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121208 486SLC2 66MHz.....\$279.95



Jameco 80486 Turbo Motherboard

- AMI BIOS
- Supports CPUs: 486DX 25/33/40/50MHz 486DX2 50/66MHz (internally) 486SX/487SX 20/25/33MHz 486 OverDrive™ 50/66MHz (internally) P24T, Cyrix CX 486S and Cyrix CX 487S
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- Supports 256K x 9, 1M x 9 and 4M x 9 flexible cache RAM 32KB/64KB/128KB/256KB (ONB installed)
- One 8-bit slot, six 16-bit slots and two (or three) Vesa slots
- Size: 8.6"W x 10.2"L • Weight: 1.6 lbs.
- One year warranty

127061 80486 Turbo MB w/o CPU\$89.95



Jameco Motherboards

- Some motherboards also available without CPU. Call for details
- Diagnostic and operating system software available
- One-year warranty

Part No.	Product No.	Description	Price
115941	80386SX 40MHz w/ CPU	.....	\$89.95
117401	80386DX 40MHz w/ CPU	.....	\$129.95
79214	80486SX 25MHz w/ CPU	.....	\$149.95
116118	80486SLC 66MHz w/ CPU	.....	\$199.95
95222	80486DX 33MHz w/ CPU	.....	\$249.95
95169*	80486DX w/o CPU	.....	\$139.95
119731	486DX2 66MHz Motherboard	.....	\$329.95
124652	Pentium 75MHz Motherboard	.....	\$479.95
124644	Pentium 75/90/100MHz w/o CPU	.....	\$299.95

* Compatible w/ DX2-66/50 or DX33/40/50

79214

Dynamic RAM

DIPs	Part No.	Product No.	Description	Price
	41620	4164-100	16 64KB x 1 100ns	\$1.39
	41435	41256-60	16 256KB x 1 60ns	2.39
	41443	41256-80	16 256KB x 1 80ns	2.19
	41371	41256-100	16 256KB x 1 100ns	1.79
	42243	511000P-70	18 1MB x 1 70ns	6.29
	42251	511000P-80	18 1MB x 1 80ns	6.19

SIMMs	Part No.	Product No.	Description	Price
	53701	94000S-70	4MB x 9 70ns	\$169.95
	53719	94000S-80	4MB x 9 80ns	164.95
	41486	41256A9B-10	256KB x 9 100ns	8.95
	41507	41256A9B-60	256KB x 9 60ns	14.49
	41515	41256A9B-70	256KB x 9 70ns	14.25
	41523	41256A9B-80	256KB x 9 80ns	13.75
	41769	42100A9B-80	1MB x 9 80ns	44.95

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- 8088/80286/80386 and compatible
- One-year warranty
- Built-in fan

Part No.	Product No.	Description	Price
19465	150 Watt (8088)	.....	\$49.95
67467	200 Watt (8088/80286)		\$59.95
19545	200 Watt		\$69.95
19529	200 Watt mini		\$49.95
65728	300 Watt		\$99.95



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114868	84-key keyboard, AT, use 114850.....	\$59.95
114850	18-key keypad for 114868 only.....	\$29.95
78297	101-key AT compatible keyboard.....	\$19.95
67432	101-key PC/XT/AT/386/486 compat.....	\$19.95
119044	101-key w/ trackball, PC/XT/AT; PS2.....	\$59.95
119167	101-key foldable, PC/XT/AT; PS2.....	\$79.95
17128	101-key enhanced keyboard.....	\$69.95
119554	101-key w/ built-in phone headset.....	\$99.95
124089	101-key multimedia keyboard.....	\$89.95
119669	124-key programmable keyboard.....	\$69.95
17136	130-key keyboard with calculator.....	\$79.95

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117348	Pentium 60/66 Heat Sink w/fan.....	\$14.95
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125701	CFS635A 635MB 3.5".....	\$229.95
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4 Button Joystick

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127212 4 Button joystick.....\$8.95



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- Microsoft® Mouse compatible
- One-year warranty
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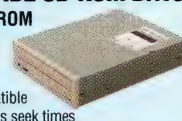
104441 3 Button serial mouse.....\$8.95



TEAC 6X IDE CD-ROM Drive

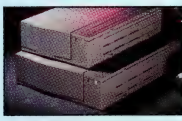
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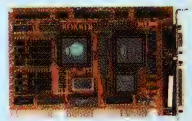


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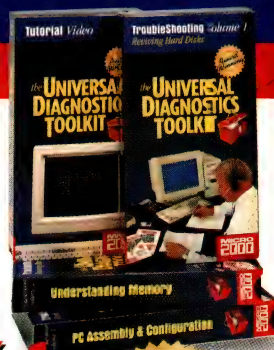
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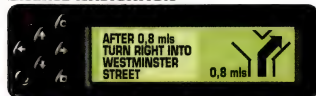


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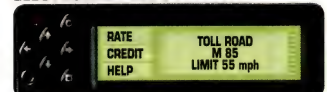
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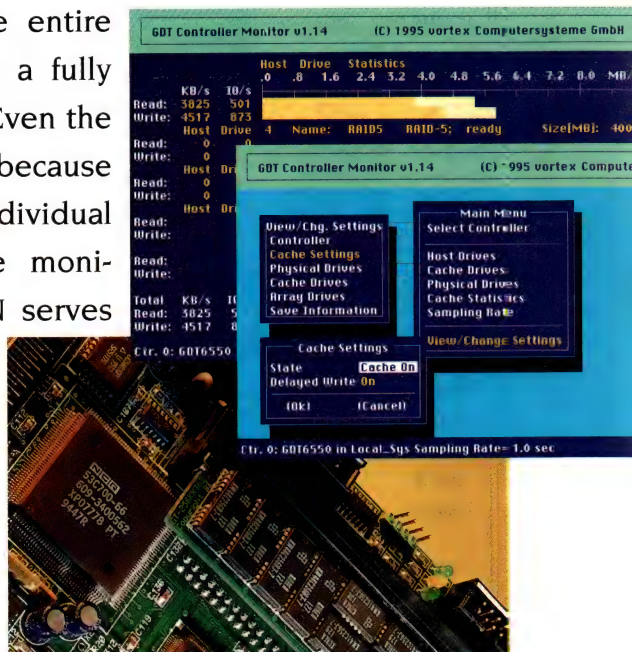
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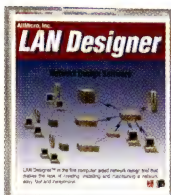
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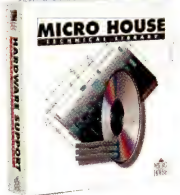
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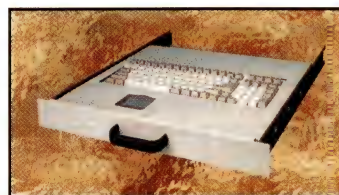


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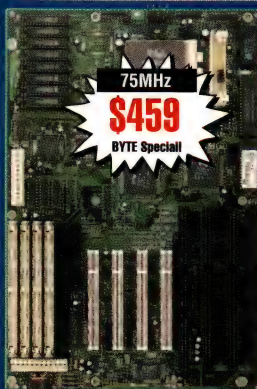
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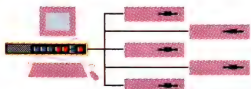


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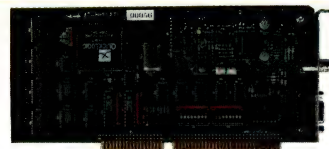
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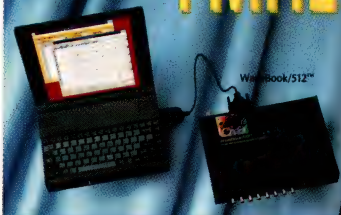
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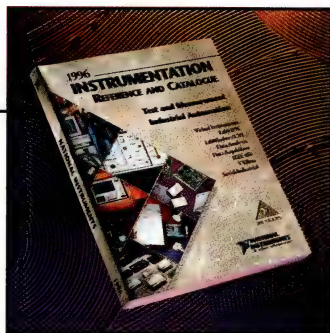


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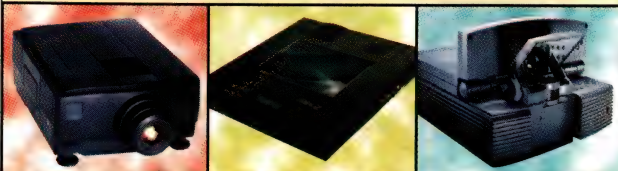
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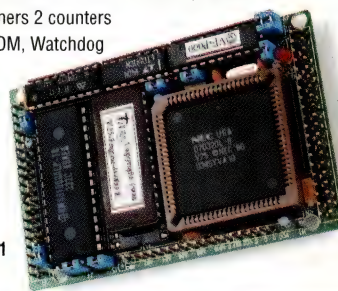
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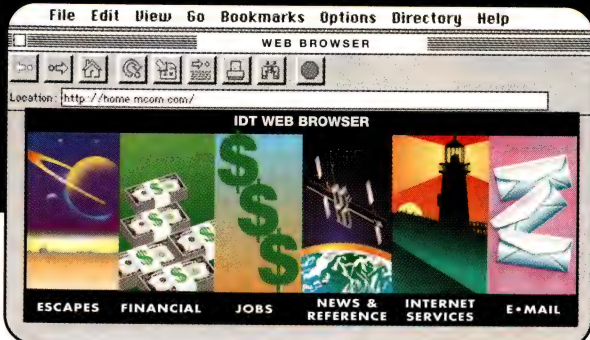


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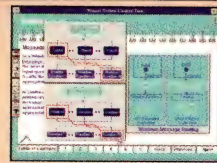
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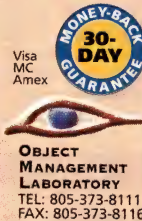
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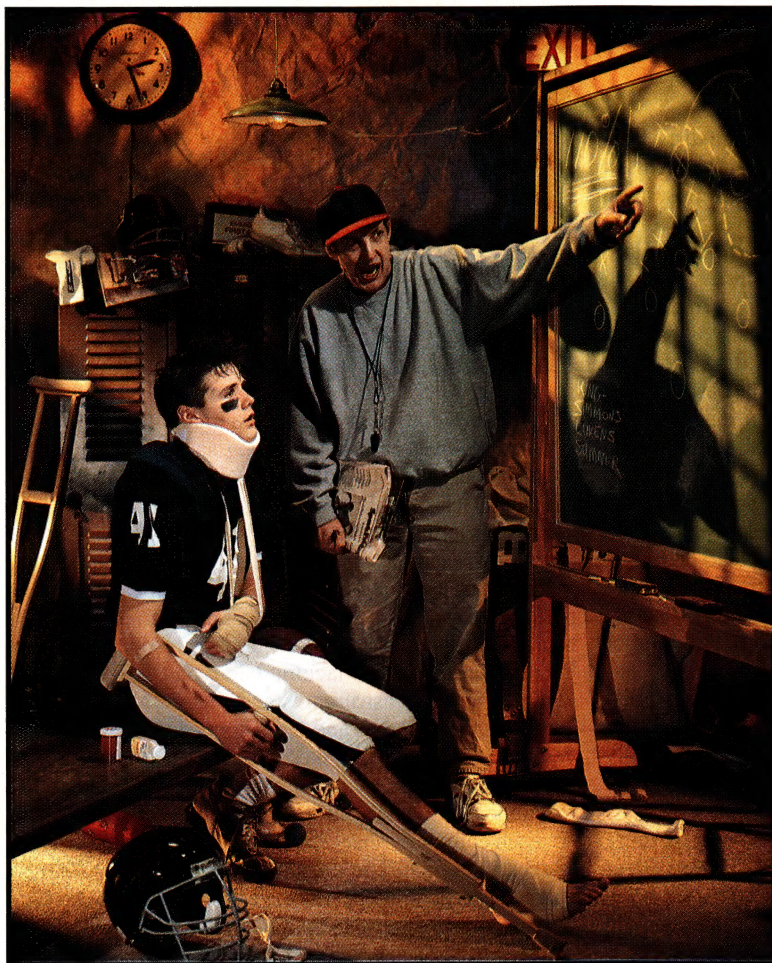
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